

Installation Manual V1

ICF[®] *tech*

advanced *construction technology*

Insulating Concrete Form
structural walling system



Quick
cost-effective

high performance
sustainable

installation manual

Consistent with ICF Tech Limited's (ICF Tech) policy of continuing research and development, we reserve the right to modify or update the information contained within this or any other material published by ICF Tech. Updates to this manual will be available for download from the ICF Tech website.

The most up-to-date version of this manual will be available to subscribers or approved installers at www.icf-tech.com

ICF Tech High Performance Wall System and any other marks, drawings or symbols identifying products and/or services of ICF Tech products are Trademarks or are Copyright belonging to ICF Tech.

ICF Tech assumes no responsibility regarding the use of its products or any other third party product referred to in this document. It is the full responsibility of the user of these products and any other products mentioned/detailed in this document, to ensure that they are installed or operated in strict adherence to the manufacturer's instructions. If training is required for these products then that is the responsibility of the user, not ICF Tech Ltd. It is further the responsibility of the user to research and understand safe methods of use and handling of these products and adhere at all times to all Health and Safety and other statutory documents, as applicable.

Preface

ICF TECH WEBSITE AND EMAIL

www.icf-tech.com – please visit for regular updates & additional product documentation, technical bulletins and other news. This installation guide and other ICF Tech and related company information is posted on this website.

info@icf-tech.com – please email for additional information or answers to particular queries.

INSTALLATION GUIDE COMMENTS

Please email us with any comments you may have on the contents of this document – we aim to keep this guide as accurate & user-friendly as possible & so your comments are gratefully received, however minor they may seem.

HEALTH AND SAFETY

To ensure your safety, the safety of your installers and other trades on the site, ensure that you comply with all required Health & Safety regulations. If in doubt ask.

KEY ICONS



Refer to this symbol for important information relating to statutory codes, regulations and material standards.



Refer to this symbol for advice on recycling of your waste material.



Refer to this symbol for important Health and Safety advice.



Refer to this symbol for best practice hints.

Contents

1	WHAT ARE ICF'S?	1
1.1	A brief history	2
1.2	Reasons for use over other forms of construction	2
2	ICF HIGH PERFORMANCE WALL SYSTEM	5
2.1	System features and components overview	6
2.2	ICF Form and components	9
2.21	HouseForms and WallForms	9
2.22	Straight forms	11
2.23	Corner forms	12
2.24	Raising pieces	12
2.25	FloorForms	13
3	GETTING STARTED	15
3.1	Hand and power tools	16
3.2	Setting out	17
3.3	Form cutting	17
3.4	Form placement from foundation level	17
3.5	Form placement from ground floor	23
3.51	Rebar placement	26
3.52	Bracing and alignment system	28
3.53	FormCloser placement	30
3.54	Lintols over and around openings	32
3.55	Simpson strongtie ledger placement	33
3.6	Concrete placement	36
3.61	Concrete boom pumps	37
3.62	Bottom-up pumping	37
3.63	Pre-Concrete pour checklist	38
3.64	Post-Concrete pour checklist	39

4	PRINCIPLES OF REINFORCEMENT	41
4.1	Spliced joints in reinforced concrete	42
4.2	Rebar placement	42
4.4	Starter bar placement	46
4.5	Cold joints	46
5	FLOORS	48
5.1	Precast beam and block - 1	49
5.2	Precast beam and block - 2	50
5.3	Ground bearing slab - 1	51
5.4	Ground bearing slab - 1	52
5.5	Pre-cast concrete plank - 1	53
5.6	Pre-cast concrete plank - 2	54
5.7	Hanson jet floor- 1	55
5.8	Hanson jet floor - 2	56
5.9	Timber suspended ground floor	57
6	CONSTRUCTION AT ROOF LEVEL	60
6.1	Wall plate fixing	61
6.2	Rafter feet connection	62
6.21	Trussed rafters	62
6.22	Cut roofs	62
6.3	Gable wall construction	63
6.31	Form placement	62
6.32	Bracing and cutting to pitch	64
6.33	Gable ladder	64

Contents

7	OTHER CONSTRUCTION	68
7.1	Basement construction	69
7.1	Tee wall	73
8	CAD DETAILS	72
9	FORM SPECIFICATIONS	102
10	PRODUCT CODES AND DESCRIPTIONS	106

Revision status

Revision		Date
0	First issue - version 1.0	28/06/09
1	References to 'fall arrest' changed to 'fall restraint'	21/09/09
2	Page 85, correction to diagram description	21/09/09

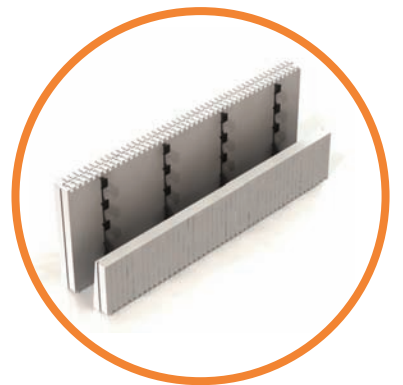
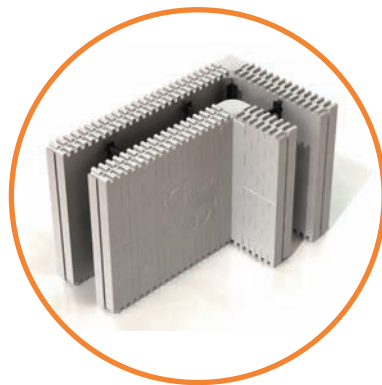
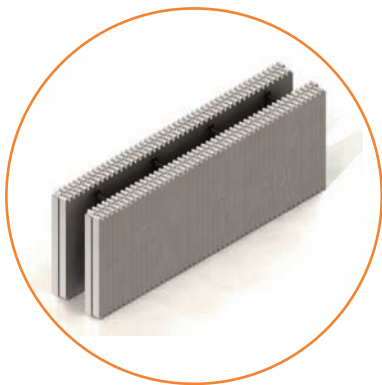
Diagrams and Tables

Fig	DESCRIPTION	Page
1	Interlock design and witness lines	6
2	Waterbar webs used with HouseForms and WallForms	7
3	Waterbars used in FloorForms to provide a vertical slurry barrier	7
4	Web, embedded into the Forms during manufacture	8
5	Bracing and Alignment system	8
6	FormCloser with installation support fitted	9
7	Rebar cradle showing lintol	9
8	Showing FormLok secured to trench block and FloorForm attached	10
9	Showing FloorLedger embedded into the concrete core	10
10	HouseForm and WallForm forms	11
11	Straight Forms	11
12	Corner Forms	12
13	SIRPs & DIRPs	12
14	FloorForms	13
15	Internal Corner FloorForm and External Corner FloorForm	13
16	FormLok installed with FloorForm pressed into place - levelled if required prior to fixing	18
17	FormLok position at corners plus use of setting-out jig	18
18	Levelling the corners	19
19	Form attached to the FormLok	19
20	Placing waterbars as the installation proceeds	20
21	Placing the FloorForms from the corner out	20
22	Detail of telescopic vent installation	21
23	Telescopic vents installed ready for the beams to be placed	21

Fig	DESCRIPTION	Page
24	Detail of liquid DPC	22
25	Beams being installed	22
26	Beams and block floor ready for the next lift of forms	23
27	Determining the height of the SIRP	24
28	SIRPIC in place	24
29	SIRPs installed and corner form installed	25
30	Straight forms installed away from the corner form	25
31	Detail of rebar located in the web	26
32	Detail of rebar overlap-splice	26
33	Diagram showing where cut forms should NOT be positioned	27
34	9mm ply used to reinforce cut form	27
35	Detail of Bracing & Alignment system installed	28
36	Detail of window clip	30
37	FormCloser being installed as ICF wall is erected	31
38	FormCloser with bracing and vent holes	31
39	Detail at the top of the window to show FormCloser, rebar cradle and rebar lintol	32
40	Typical rebar placement around openings	32
41	Example of loading calculation to determine the no. of ledgers	33
42	Floor Ledger inserted into the Form ready for the concrete core to be filled	33
43	FloorLedger detail showing fixing screws	34
44	Detail of fixing arrangement when using cassette floor systems	35
45	Concrete pouring using a double S reducer	36
46	Bottom-up pump assembly	37

Fig	DESCRIPTION	Page
47	Detail of starter bar reinforcement	46
48	Precast beam and block floor – section taken where beams span on to ICF wall	49
49	Precast beam and block floor – section taken where beams span parallel to ICF wall	50
50	Typical Ground Bearing Slab	51
51	Typical ground bearing slab with level threshold	52
52	Precast concrete plank – section taken where planks span parallel to ICF wall	53
53	Precast concrete plank – section taken where planks span on to ICF wall	54
54	Hanson Jetfloor - section taken where planks spans parallel to ICF wall	55
55	Hanson JetFloor – section taken where beams span on to ICF wall	56
56	Typical timber suspended ground floor	57
57	Detail of wall plate and FormLok at roof level	61
58	Detail of Roof Truss and Wall Plate	62
59	Forms built-up next to roof truss prior to cutting	63
60	Gable end wall showing cut forms ready for concrete pour	64
61	Detail of Gable Ladders	65
62	Detail of gap in FormCloser at top of Gable Wall	65
63	Preferred arrangement for forming ‘T’ walls	70
64	Rebar and tie-wire detail	70
65	Retaining wall - basement	73
66	Retaining wall - corner	74
67	Retaining wall - tee	75
68	Roof truss - eaves level	76
69	Raised collar - eaves detail	77

Fig	DESCRIPTION	Page
70	Truss roof	78
71	HouseForm 100mm (SF100)	79
72	WallForm 150 (SF150)	80
73	CornerForm 100 (CF100)	81
74	CornerForm 150 (CF150)	82
75	FloorForm 100 (FF100)	83
76	FloorForm 150 (FF150)	84
77	FloorForm ext. corner (FFEC100)	85
78	FloorForm ext. corner 150 (FFEC150)	86
79	FloorForm int. corner 100 (FFIC100)	87
80	FloorForm int. corner 150 (FFIC150)	88
81	Rebar Cradle	89
82	FormCloser	90
83	FormCloser assembly details - 1	91
84	FormCloser assembly detail - 2	92
85	Detail for vertical tile hanging	93
86	Hanson Jetfloor - section taken where planks spans parallel to ICF wall	94
87	Hanson Jetfloor - section taken where planks spans parallel to ICF wall	95
88	Hanson Jetfloor - section taken where planks spans parallel to ICF wall	96
89	Hanson Jetfloor - section taken where planks spans parallel to ICF wall	97
90	Hanson Jetfloor - section taken where planks spans parallel to ICF wall	98



1

What are ICF's

1 What are ICF's?

1.1 A brief history

ICF stands for Insulating Concrete Forms, which were first developed in Germany in the Late 1950's by BASF, their first product being called the "Igloo" for obvious reasons.

ICF's have been a viable form of wall construction in mainland Europe since that time, but have come to prominence in North America and Canada over the last 15 years to be a recognised and respected form of Construction, with over 50 makes in production and estimates of between 7 and 12% market share for domestic house construction alone.

» BLOCK systems

These are modular blocks with either polymer, steel or Expanded Polystyrene (EPS) webs holding parallel sheets of EPS together, forming a hollow block which is filled with concrete, once a certain height has been reached.

» PLANK systems

Which are similar to BLOCKS as they have parallel EPS walls, but these are held together with rails and wall ties which are not moulded into the EPS walls during manufacture, as those above which use polymer or steel webs. Quadlock is an example of such a PLANK system.

» PANEL systems

Similar to BLOCK systems but made in much larger formats, typically 2.4m. in height by 1.2m. wide.

1.2 Reasons for use over other types of wall construction

The Governments commitment to the Kyoto Accord has meant the ever-increasing need for higher levels of thermal insulation requirements which has seen "U" values (a measure of a building components Thermal Transmittance) increase year on year since the late 1990's.

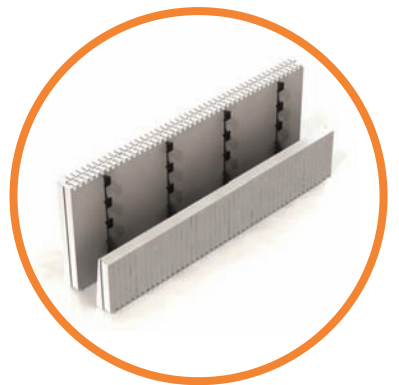
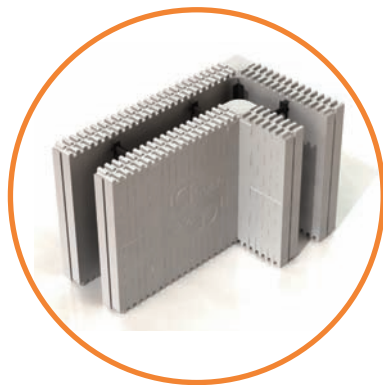
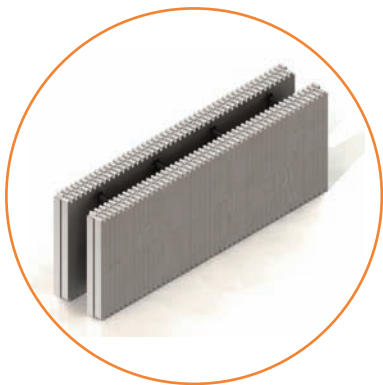
The "U" values for external walls have risen to such an extent that traditional cavity wall construction is finding it difficult to meet the new requirements – already with a 100mm cavity to accommodate thicker insulation to achieve a 0.35 "U" value with 0.25 values imminent.

Although timber frame systems are not finding the increased regulations too taxing, the advantage ICF's have over this form of construction is lead-in times, as typically a timber-framed solution will take three to four months to design and deliver to site, whereas an ICF is ready to be delivered ex-stock.

Our ICF HouseForm has a "U" value of 0.19 using normal pumped concrete, and can easily achieve 0.11 by using insulated plasterboard instead of the normal 12.5mm plasterboard, yet only 348mm thick!

ICF's also have very high levels of air-tightness, an issue which is being given even higher importance than thermal efficiency, as the air-leakage from buildings through air-exfiltration takes with it more hot air than that lost through the walls due to thermal inefficiency, and thus is adding to the carbon-load placed on the heating system to replace the lost heat, due to the requirement to burn more fossil (or carbon) based fuels.

ICF's due to their monolithic concrete core are inherently air-tight, especially when combined with our FormCloser system around structural openings. The ICF Tech system can achieve air infiltration figures as low as $0.74\text{m}^3/\text{m}^2/\text{hr}$ @ 50Pa.



2

The ICF Tech high performance wall

2 The ICF Tech high performance wall

2.1 SYSTEM FEATURES & COMPONENTS OVERVIEW

The ICF Tech walling system is the result of many years research and development and is currently the only ICF designed in the UK for the UK domestic and commercial construction sectors. It has been designed specifically to seamlessly use all types of concrete or lightweight flooring and roofing systems, even down to full width void vents.

Our approach was to design a complete ICF system, not just the Forms. This means we supply every component required to get you from the foundation to the roof plate with ease. The system hosts many features to make building with ICF's even more enjoyable and combine to help you finish your project professionally, and safely.

The following pages detail the features of the ICF Tech system that make it stand out from imported systems from overseas and why it is the choice for serious developers looking to gain a higher specification building solution without increasing costs.

From the any-way-up interlock design to the innovative way in which any floor thickness can be accommodated, you will see why choosing the ICF Tech system is a safe bet towards high performance construction.

Interlock Design and witness lines

The most noticeable difference with our system is the interlock – designed to provide a slurry-proof seal and friction fit ensuring that your bedding joints do not leak or float apart when being filled with concrete. There is no face-out or top/bottom, just pick it up and lay it and with a 25mm interlock repeat, you can save on waste and adapt existing plans with more accuracy. Witness lines on the face of the forms ensure accurate on-site cutting and show where you can fix to.

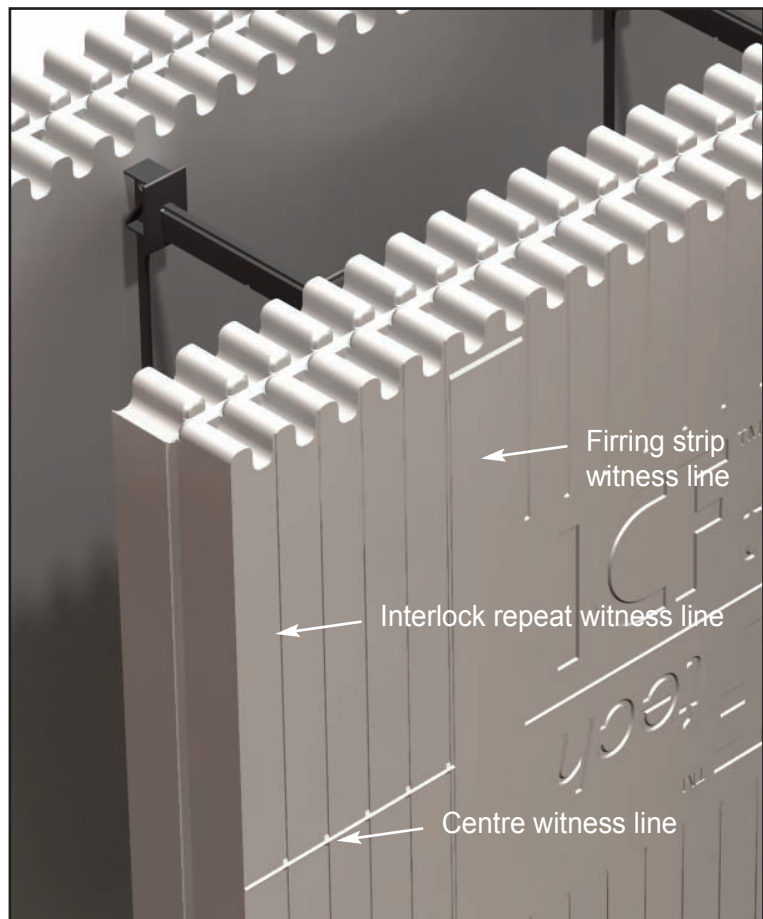


Fig 1 - Interlock design and witness lines

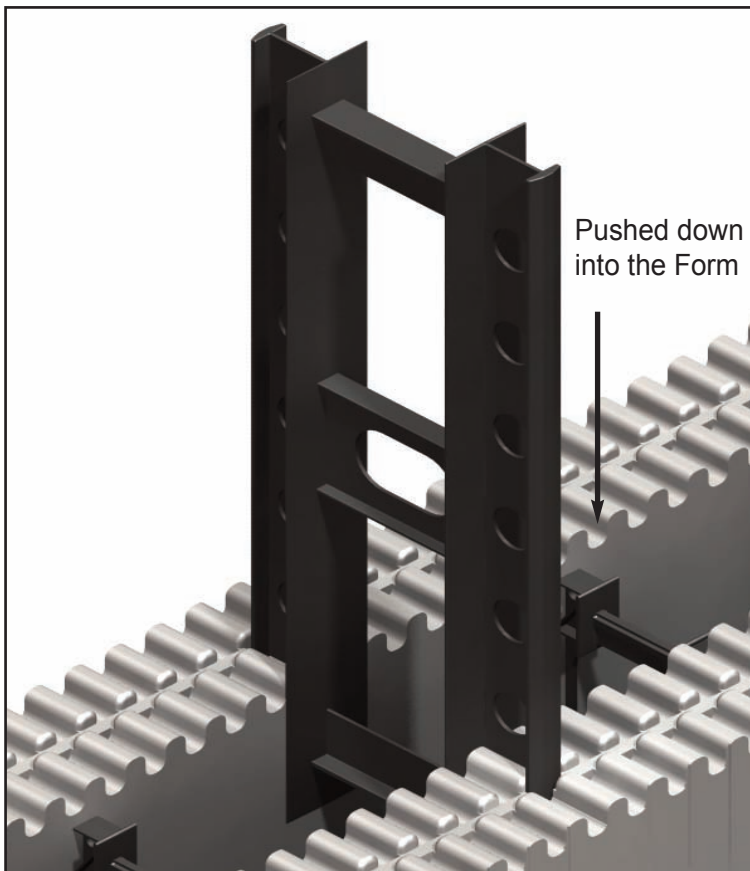


Fig 2 - Waterbar webs used with HouseForms and WallForms

Waterbar webs

The perpendicular or vertical joint of the Forms of any ICF block are a weak area. If unsupported the pressure of the concrete can force these perpendiculars apart and cause a blow-out if you are not careful.

To overcome this, the ICF Tech System was designed with higher density EPS to give an increased tensile strength, but we also designed the Waterbar web which acts both as a vertical barrier to concrete slurry and also to strengthen the perpendiculars by helping to resist the pressure of the concrete acting on the unsupported EPS panels.

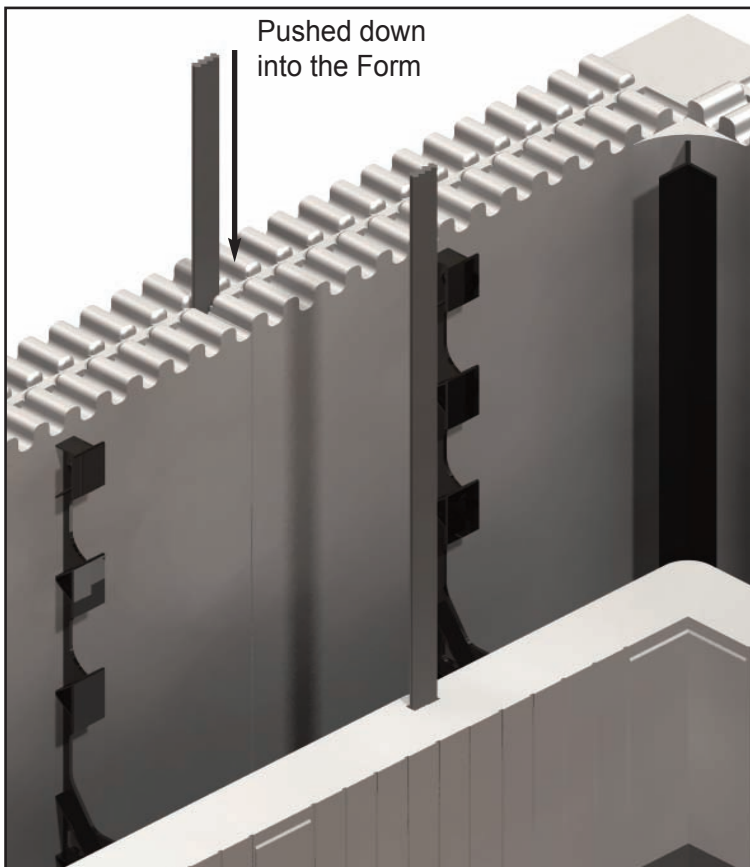


Fig 3 - Waterbars used in FloorForms to provide a vertical slurry barrier

Waterbars

When using FloorForms there is no need for a waterbar web. To stop slurry seepage at the vertical junction between forms, we have designed a waterbar with a zigzag design that increases the surface area of the plastic as it slide fits into purpose moulded channels at the ends of the Forms.

Webs

Embedded at 300mm centres into the Forms our webs have been designed for maximum fixing strength, and have also been designed to accommodate UK standard rebar sizes, when required and have a snap-in clip for horizontal rebar placement. We also have the only full height vertical corner web, ensuring full-height, right to the corner fixing on external and internal corners.

Designed to hold up to 64kg/m^2 with a comfortable factor of safety and an incredibly strong pull-out resistance so screws stay firmly fixed.



Fig 4 - Web, embedded into the Forms during manufacture

Bracing & Alignment System

Our lightweight demountable system conforms to the current Work at Height Regulations 2005 No. 735 and is designed to both brace and plumb the ICF wall against wind loading and during concrete pour/cure. It also provides a safe working platform for form and concrete placement.

A simple turnbuckle design moves the top of the wall in or out so that checks prior to, and after, the concrete pour ensure that the wall remains perfectly plumb, and perfectly straight.



Fig 5 - Bracing and Alignment system



Fig 6 - FormCloser with installation support fitted

FormCloser

The FormCloser is used to seal the openings in the ICF wall whilst providing a rapid fixing solution for window and door frames.

Designed to replace subframes thereby reducing site operations. Due to its insulated core, thermal bridging is minimised. Health and Safety issues are further addressed as the system has been designed to facilitate internal window fixing.

The FormCloser is also used to finish gable construction and capping off vertical end wall sections.

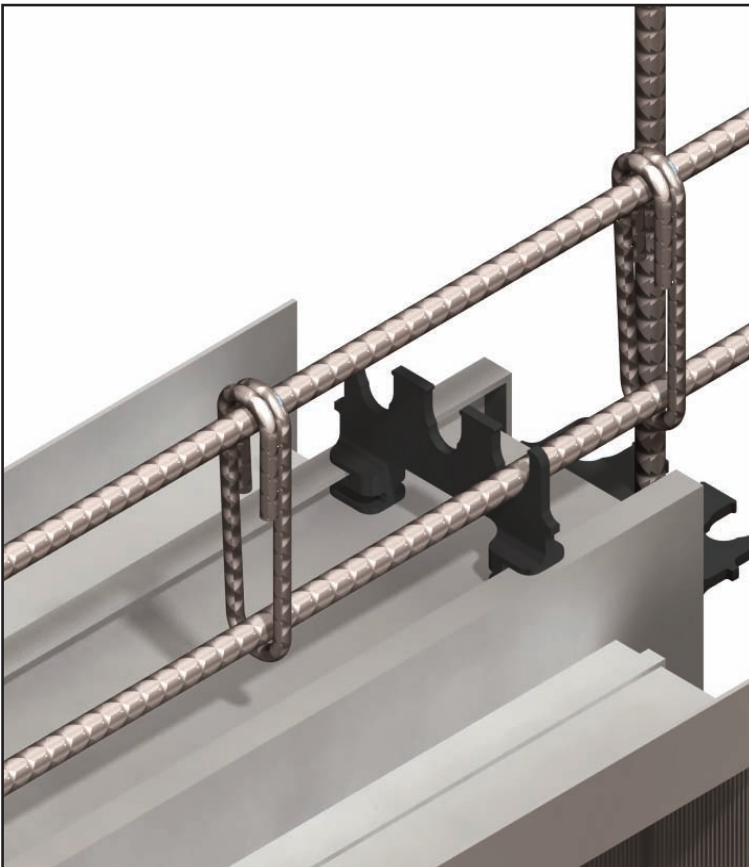


Fig 7 - Rebar cradle showing lintol

Rebar Cradle

Another first for the ICF Industry – our rebar cradle twists into the back of our FormCloser to allow accurate placement of rebar to form reinforced lintels over structural openings negating the need for factory-formed lintel units as some ICF producers require.

The correct concrete cover is maintained and allows for complex lintols to be designed and placed with ease. Rebar is simple held in place with twisting wire.

FormLok

The key to the success of any building project is accurate setting-out. This is never truer than when setting out the first course of forms from the foundation. Our FormLok is a simple yet effective means of providing a fixing for the form whilst also providing an accurate means of setting-out the perimeter of the wall.

The FormLok is shot fired into place and when the Forms are inserted and levelled they can be screwed to the FormLok to ensure that they stay put during windy site conditions.

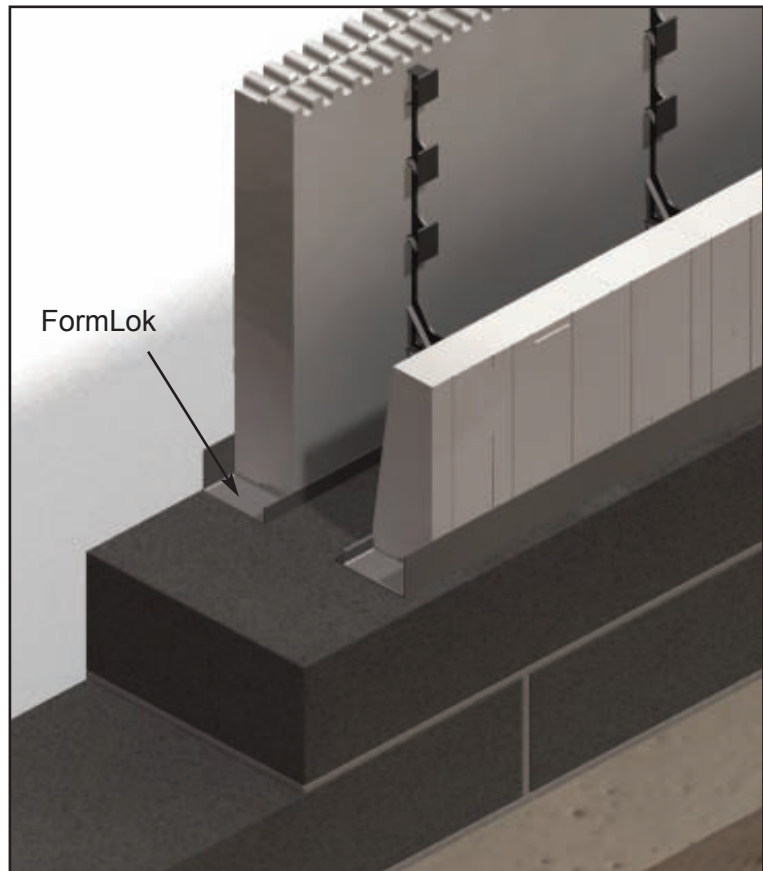


Fig 8 - Showing FormLok secured to trench block and FloorForm attached

Floor Ledger System

The Floor Ledger provides a mechanical fixing point for the fixing of timber floors to our ICF walling system. The Floor Ledger is embedded within the concrete core and when used in conjunction with a timber ledger, provides a strong fixing for joist hangers. The Floor Ledger is compatible with all types of timber/composite floors, including TJI and composite cassette floors.

The Ledger can also be used for connecting internal stud walls, where required and for providing fixing points for heavy loads.

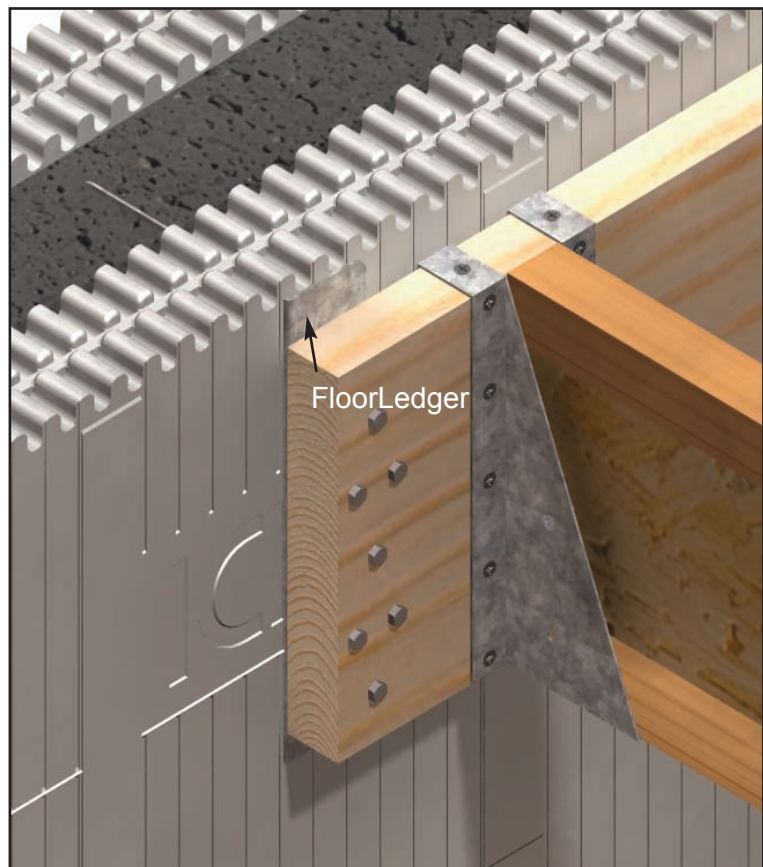


Fig 9 - Showing FloorLedger embedded into the concrete core

2.2 ICF FORMS AND FORM COMPONENTS

2.21 HouseForms and WallForms

The ICF Tech system has been designed around two structural core sizes to meet the needs of two distinct building sectors; domestic housing and commercial properties.

The 100mm HouseForm is designed for building 3 storey town houses or apartments with intermediate concrete floors, yet creates a wall as little as 250mm thick. The 150mm WallForm is suitable for building larger apartment blocks and commercial buildings and its concrete core size makes it suitable for party wall construction.

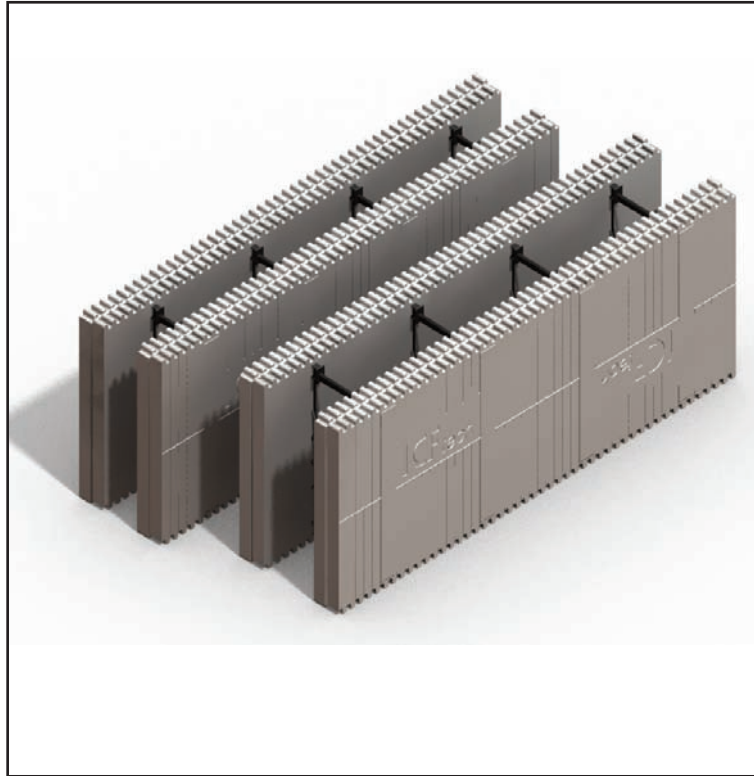


Fig 10 - HouseForm and WallForm forms

2.22 Straight Forms

All straight forms measure 1200mm long by 450mm high and a width of just 250mm or 300mm. Each EPS panel is 75mm thick and made from 30g/ltr EPS.

Each form has external markings to show where the form can be cut to maintain the interlock integrity - every 25mm. A horizontal witness line also gives guidance when the form needs to be cut horizontally. An embossed area, 44mm x 440mm indicates where fixing screws can be used to attach internal or external cladding/material. These are arranged 150mm from the ends and then at 300mm centres.

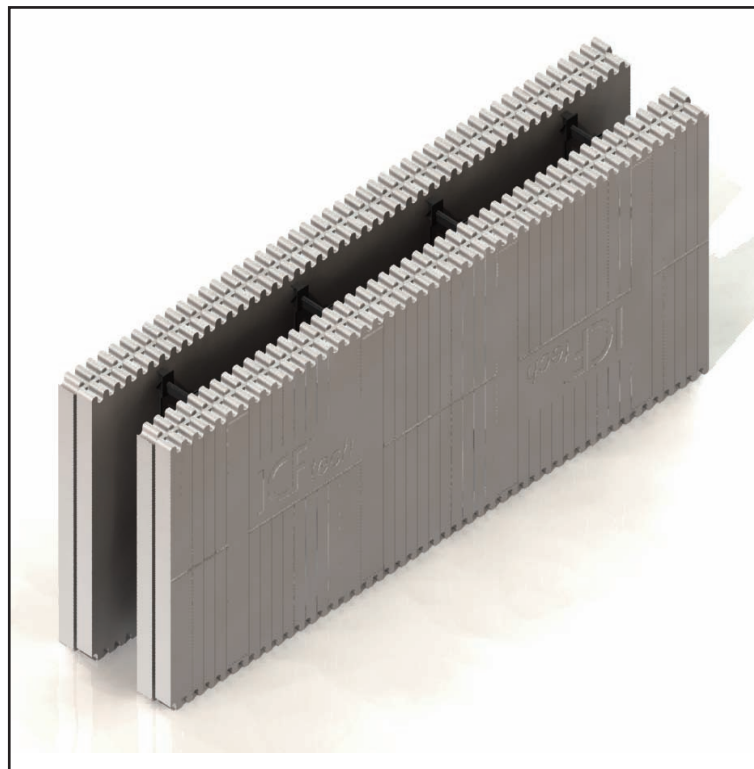


Fig 11 - Straight Forms

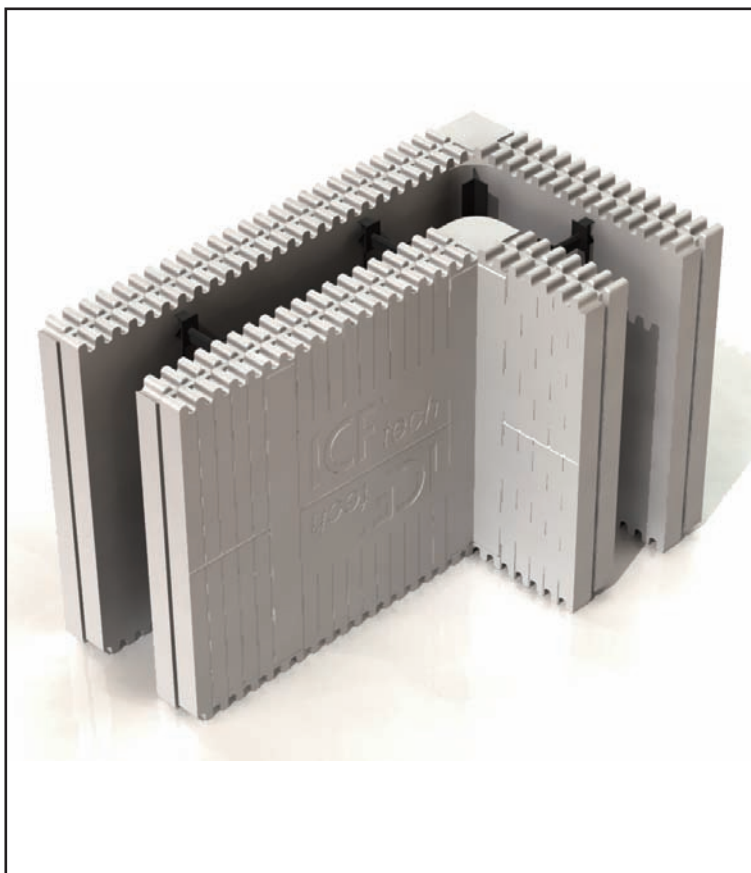


Fig 12 - Corner Forms

2.23 Corner Forms

Corner forms are used to change the direction of the wall by 90 degrees. As our interlock allows the form to be turned over by 180 degrees, the shape allows for the staggering of the vertical coursing to create the stretcher bond effect, so you do not need to worry about which hand the form is, so long as you maintain the stagger.

The Corner Form is 725mm x 425mm externally and 475mm x 175mm internally. All forms are 450mm high when bonded. EPS skins are 75mm and made from 30g/ltr EPS.

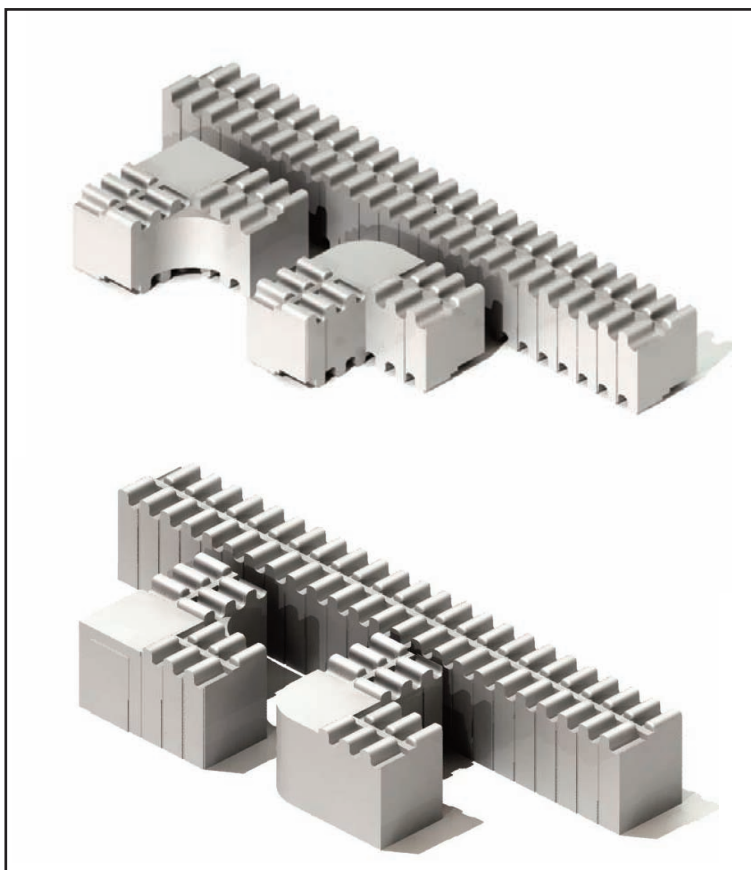


Fig 13 - SIRPs & DIRPs

2.24 Raising Pieces

With a Double Interlock Raising Piece (DIRP) you can easily increase the coursing height by 75mm at a time. This is used where the wall height needs to be increased by a standard brick course.

By using a Single Interlock Raising Piece (SIRP) you can build straight from a finished concrete floor using the FormLok to quickly place the raising piece and adapt to differing floor finishes. The SIRP comes as a standard 100mm high unit and can be cut to suit the finished floor level.

2.25 FloorForms

As the name suggests, the FloorForm creates the structural platform ready to receive heavy floor construction such as concrete beam and block, precast concrete hollow-core floors, and composite steel/concrete floors due to its corbel area, which unlike other ICF's does not protrude from the internal face of the form, so can be used in intermediate floor construction.

The FloorForm comes in straight, as well as corner variants for both internal and external corners. As with the straight forms, it has either a 100mm or 150mm core.

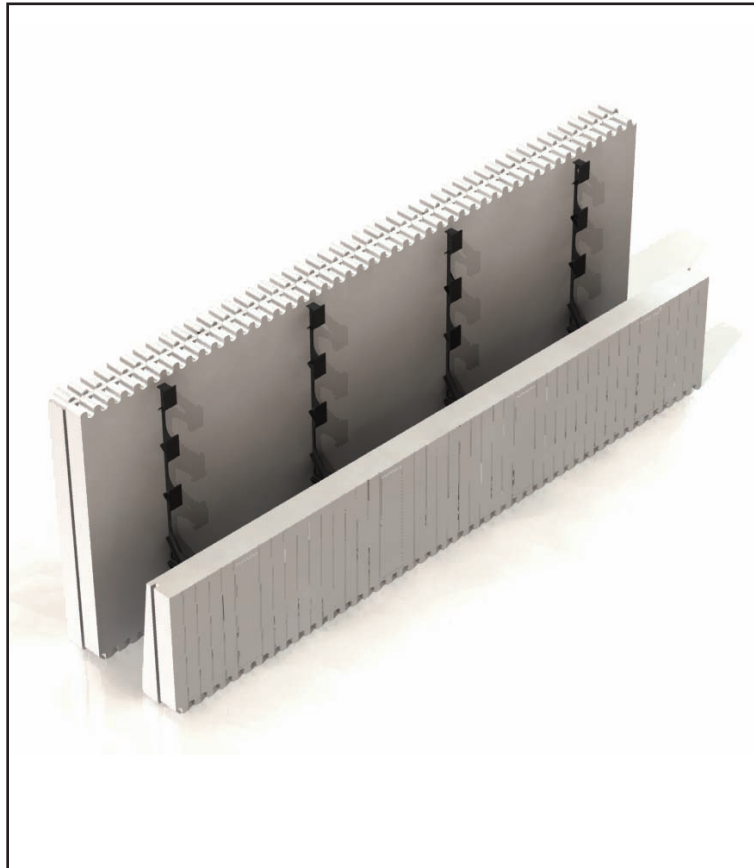


Fig 14 - FloorForms

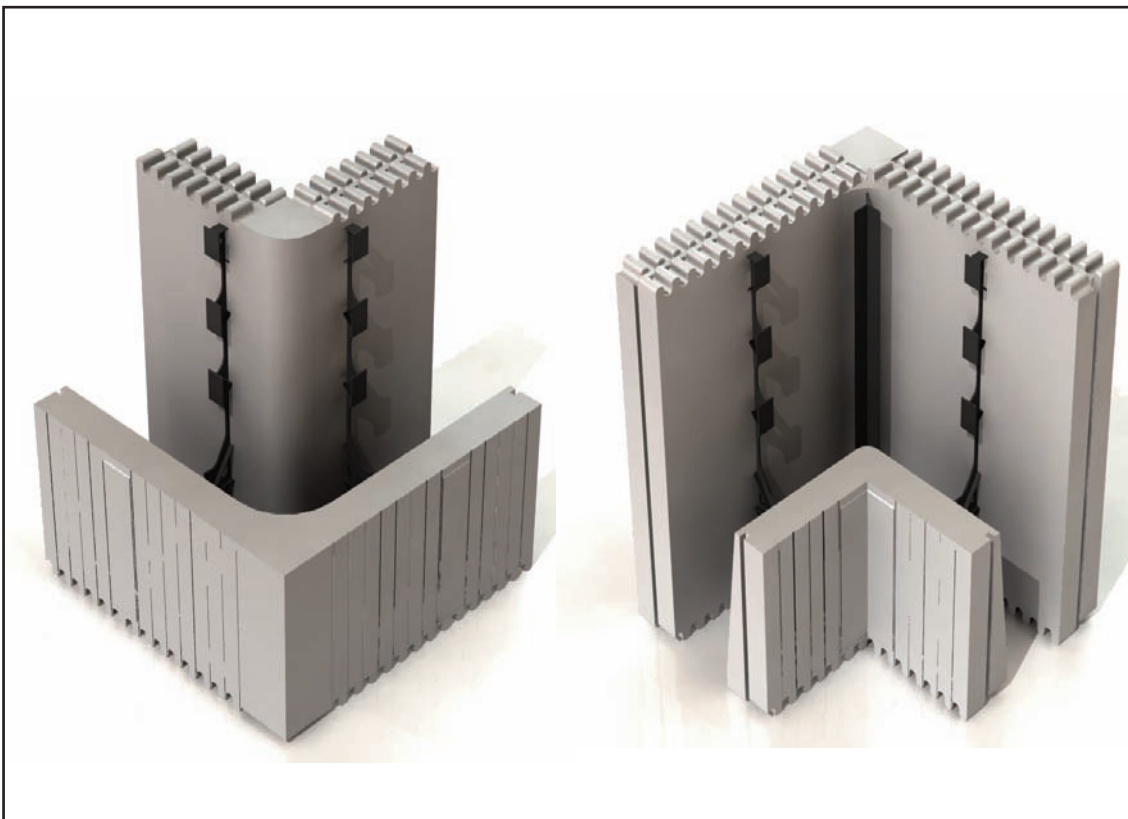
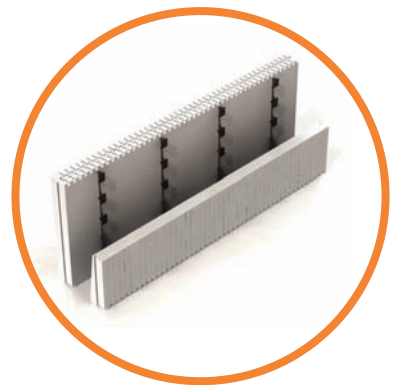
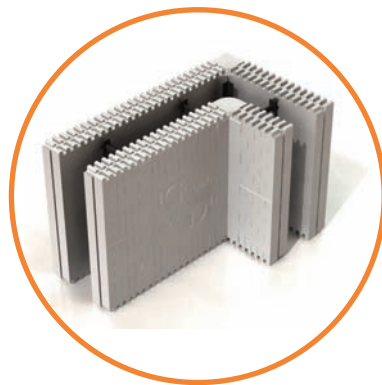
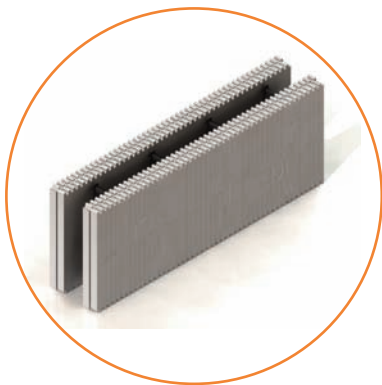


Fig 15 - Internal Corner FloorForm and External Corner FloorForm



3

Getting started

3 Getting started



Care must be taken when using hand and power tools. Ensure that you have been given adequate training and instruction before using any tools. Ensure that the correct PPE is provided and worn at all times.

**IF IN DOUBT
DO NOT USE
THE TOOL!**

3.1 HAND & POWER TOOLS

Erecting an ICF wall does require the use of some specialist tools, although the majority are non-specialist. In order to further increase wall erection times, we use of the following specialist tools;

Hot wire table

'Block Buddy' The quickest and easiest way to cut your forms to length. With a long stroke (600mm) and the ability to cut complex angles, this tool makes clean work of accurately cutting the EPS Forms.



Saws

Cutting EPS and the polypropylene webs is easily accomplished using a sturdy hand saw such as the Stanley Fat-Max range. Use of a smaller 'wall board' saw is also recommended for smaller cuts. Reciprocating saws can also be used.



Combi, masonry drills & impact drives

With the capacity to drill and hammer, these drills make light work of fixing the Bracing and Alignment system to the deck as well as other site-fixing jobs. Rechargeable and with a long battery life, these are an essential part of the installation kit.



Hot knife

The perfect tool for chasing the EPS wall to make service conduits for electrical cables and fittings and plumbing pipes etc. Use with a sled to ensure correct depth of cut.



Nail gun

For quick and accurate fixing of the FormLok and other items into concrete or other hard materials use a gas cartridge nail gun.



Foam adhesive

For fixing the bottom of Forms to the substrate if not using the FormLok and for closing any gaps and glueing cut forms. in the wall prior to the concrete pour. We recommend the use of a foam gun as opposed to foam cans, as they are more accurate to place, more cost-effective and are easier to clean.



3.2 SETTING OUT

Most domestic structures can be founded on foundations designed using Approved Document A1/2 Section 2E – Foundations of Plain Concrete. It is worth mentioning that foundation design by a structural engineer may reduce the size of foundation, due to the reduced weight of the ICF wall, which can also help when building on marginal ground.

The accuracy of the foundations will effect the accuracy of your ICF Tech wall, so it is advisable to only use skilled ground workers to prepare your site and form the foundations, as it is necessary to create level foundation which do not deviate +/- 5mm over 3m and generally not more than +/-5mm between levels taken at opposing sides of the building.

3.3 FORM CUTTING

Forms will need to be cut to accommodate the linear dimensions of the Building. Even if the Designer has chosen to work with our form sizes, forms will require cutting to allow for window and door openings.

Forms may be cut with a handsaw, but ICF Tech recommend a hot wire knife system such as the Block Buddy by Demand Products Inc. This site tool acts as a working platform whilst cutting and will produce perfectly straight cuts, each and every time. Once a form has been cut, the waterbar recess needs to be formed by using the Groove Jet fitted with the Waterbar profile. This will allow the Waterbar to be properly inserted. Similarly, the Single Interlock Raising Piece (SIRP) can also be cut with either the Groove Jet with a knife attachment or by using the Block Buddy.

3.4 FORM PLACEMENT - From foundation level

For the following examples we will assume that the build will progress from a standard strip foundation and not from a cast slab. Because of the difficulties in establishing a suitably level strip foundation, remember you need +/- 5mm over 3m, we recommend that trench block is used as it is easier for the correct level tolerance to be established and maintained.

When building a concrete first floor, be it beam and block or cast slab or other systems such as Hanson Jetfloor, we use a first course of FloorForm as this will accommodate any type of ground floor system available. Once the trench block has been built to the correct level, ensuring that the top of *foundation level* to *formation level* of the ground floor equates to the height of the trench block plus the corbel of the FloorForm) the first step is to secure the FormLok to the trench block simply by shot firing. It is not usually necessary to level the FormLok with shims, or the base of the Forms themselves, as most irregularities in level can be removed when the Form is pushed into the FormLok (see Fig 16).

When setting out and securing the outer section of FormLok, remember to allow for the inside curved face of the corner FloorForm (and corner forms), i.e. leave 125mm from each edge (see Fig 17). Use of the setting-out jig will speed-up FormLok placement (Fig 17). When the FormLok is secure you can start fitting the first form. All setting out should start, as with traditional forms of construction, from the corners. By setting out in the manner described above, and working around the perimeter of the wall (left to right), a logical sequence of cutting will be established which will help maintain a level first course.



Refer to
Approved
Document A



always cut to the witness lines otherwise your subsequent course of Forms will not interlock properly. Remember to cut the slot for the last waterbar in the end of the cut form – this is easily achieved using a hot knife or reciprocating saw.



When constructing the ICF wall, DO NOT use batches of Forms that are more than two manufacturing weeks apart from each other due to settling dimensional changes.



It is good practise to use only one 'outside' run of FormLok on the outside skin of the EPS and to seal any gaps with foam prior to the concrete pour.

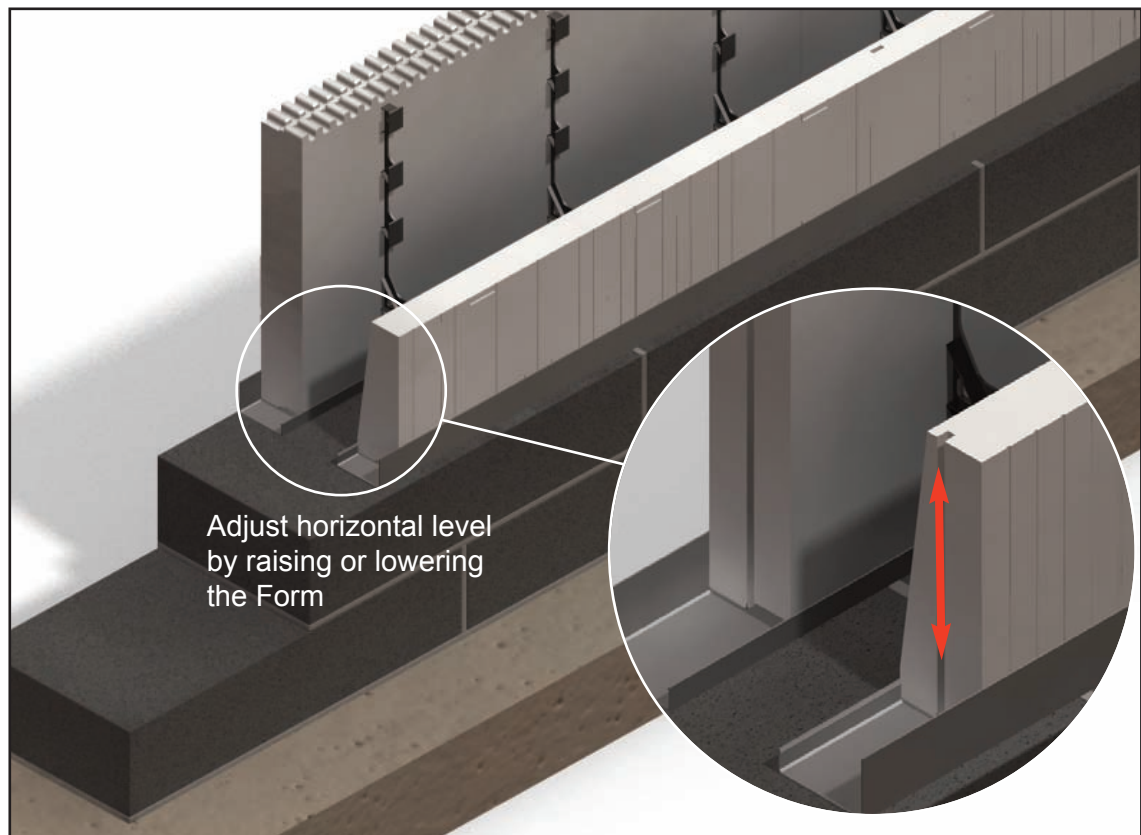


Fig 16 - FormLok installed with FloorForm pressed into place - levelled if required prior to fixing

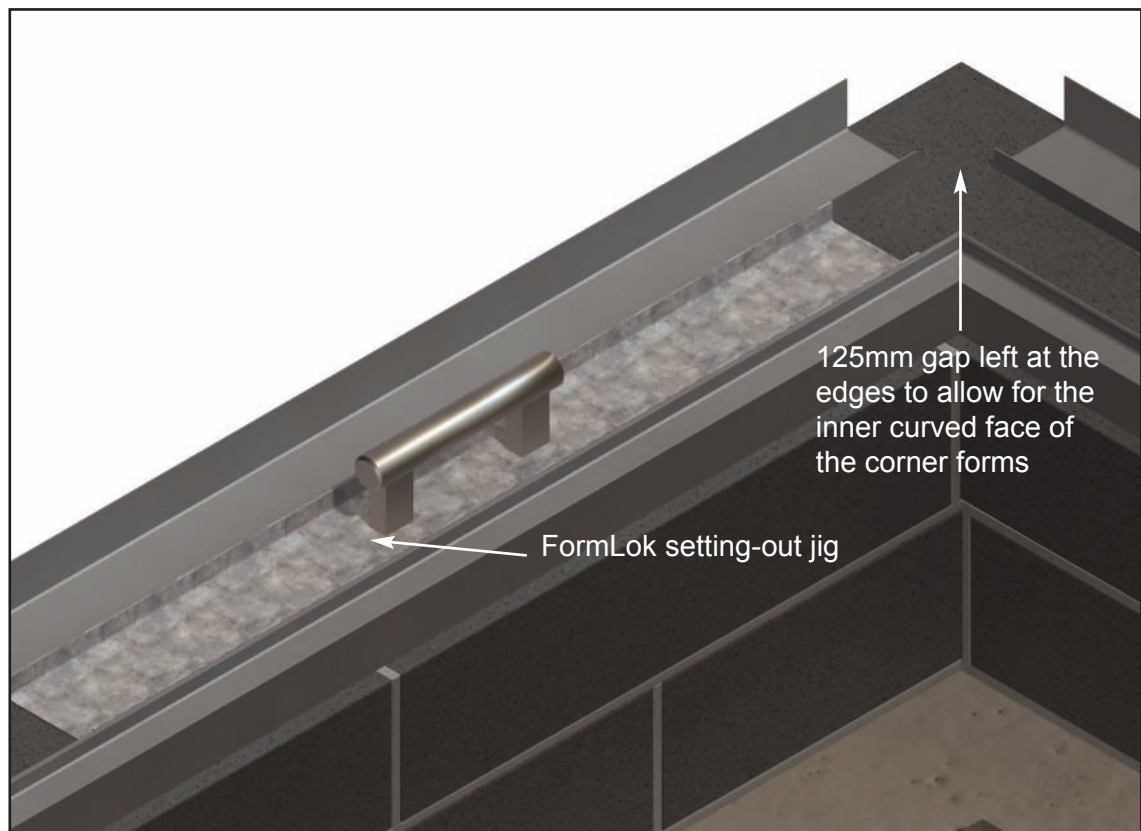


Fig 17 - FormLok position at corners plus use of setting-out jig

It is recommended that spot-levels are taken at each corner to find which is the highest, as all form placement is set-out from the corners. The lowest corners can then be raised within the FormLok to the desired height, which should be no more than 5mm if the foundations have been laid correctly. If greater irregularities occur, you can bed the FormLok on to mortar and shot fire once the mortar has set. Alternatively, use plastic shims below the FormLok, shot firing through the shims to secure the FormLok and maintain level. **To save time and effort, make sure your ground worker is accurate.**

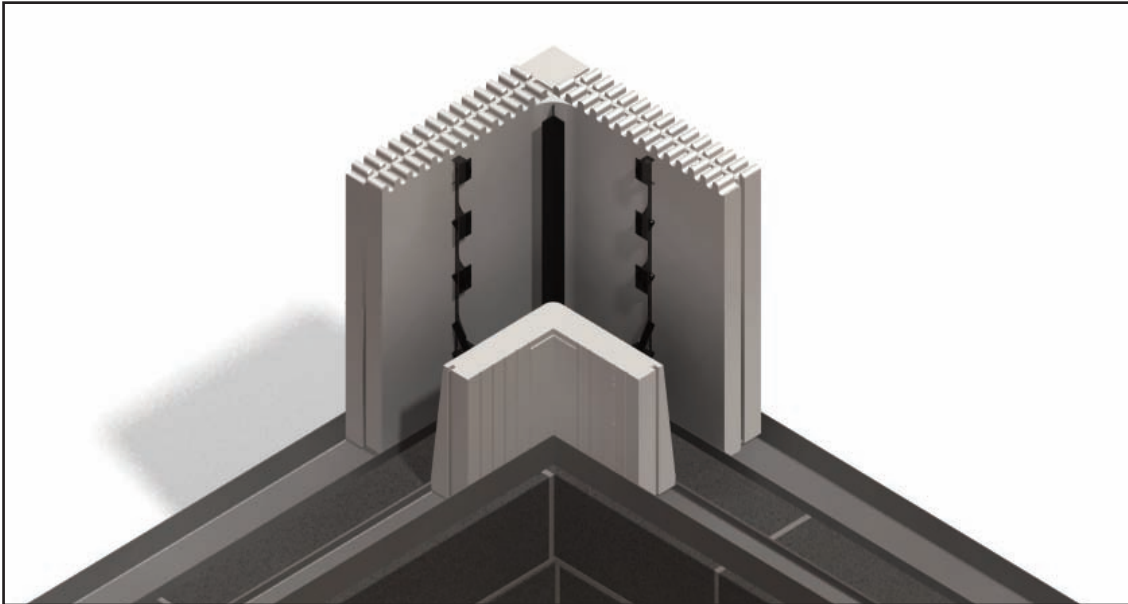


Fig 18 - Levelling the corners

Once the Corner Forms have been placed and fixed to the FormLok (Fig 18), work from the corners, placing FloorForms working toward the corners (Fig 21), remembering to place the Waterbar in each vertical joint (perpend) as placing proceeds (Fig 20). As your foundation has already been set-out to ICF Tech sizes, any cut forms required to complete a straight run of Forms will be made along one of the vertical witness lines that denote the interlock repeat (25mm centres).

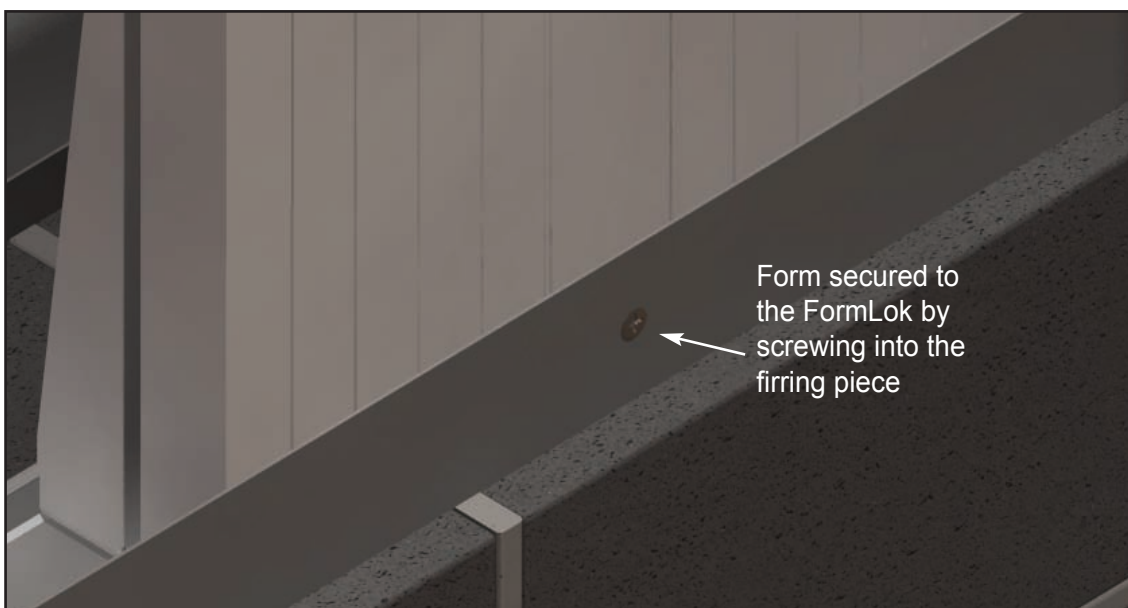


Fig 19 - Form attached to the FormLok



On the short side of the FormLok, don't forget to cut the waterbar to the correct length.

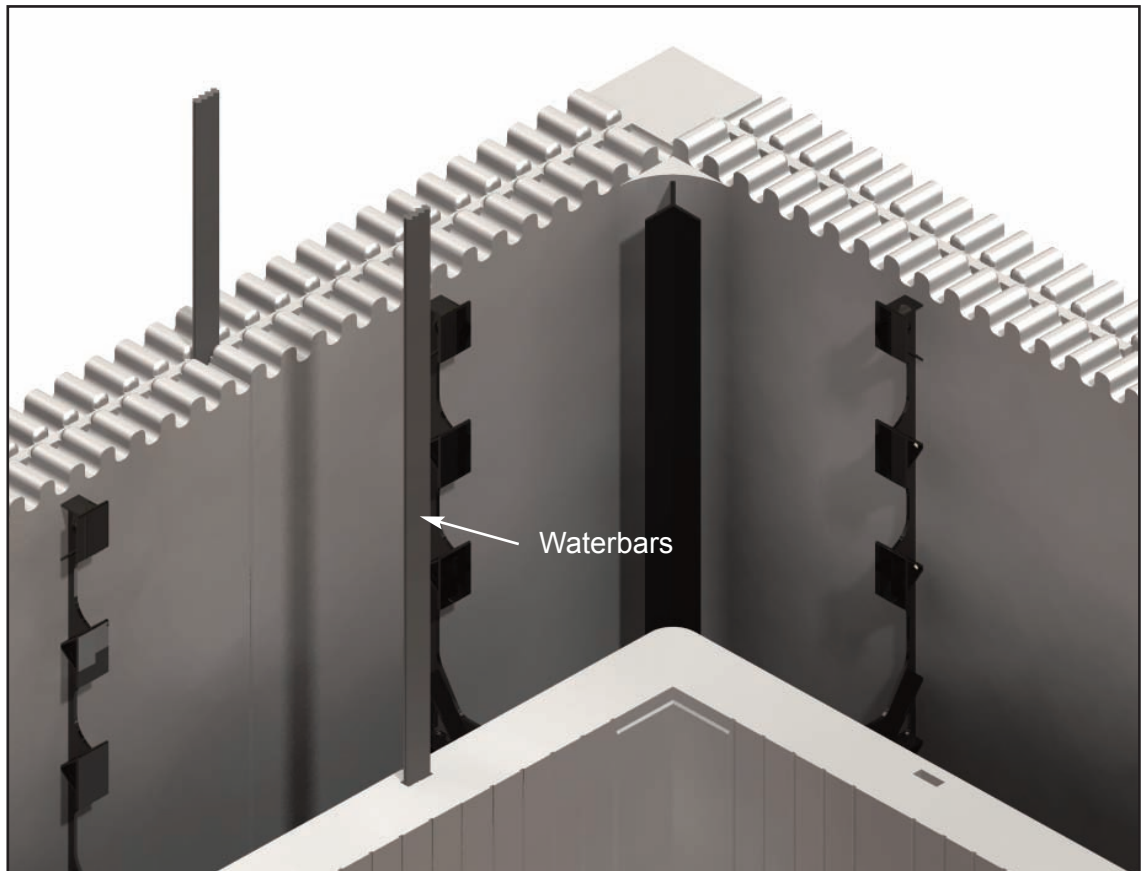


Fig 20 - Placing waterbars as the installation proceeds

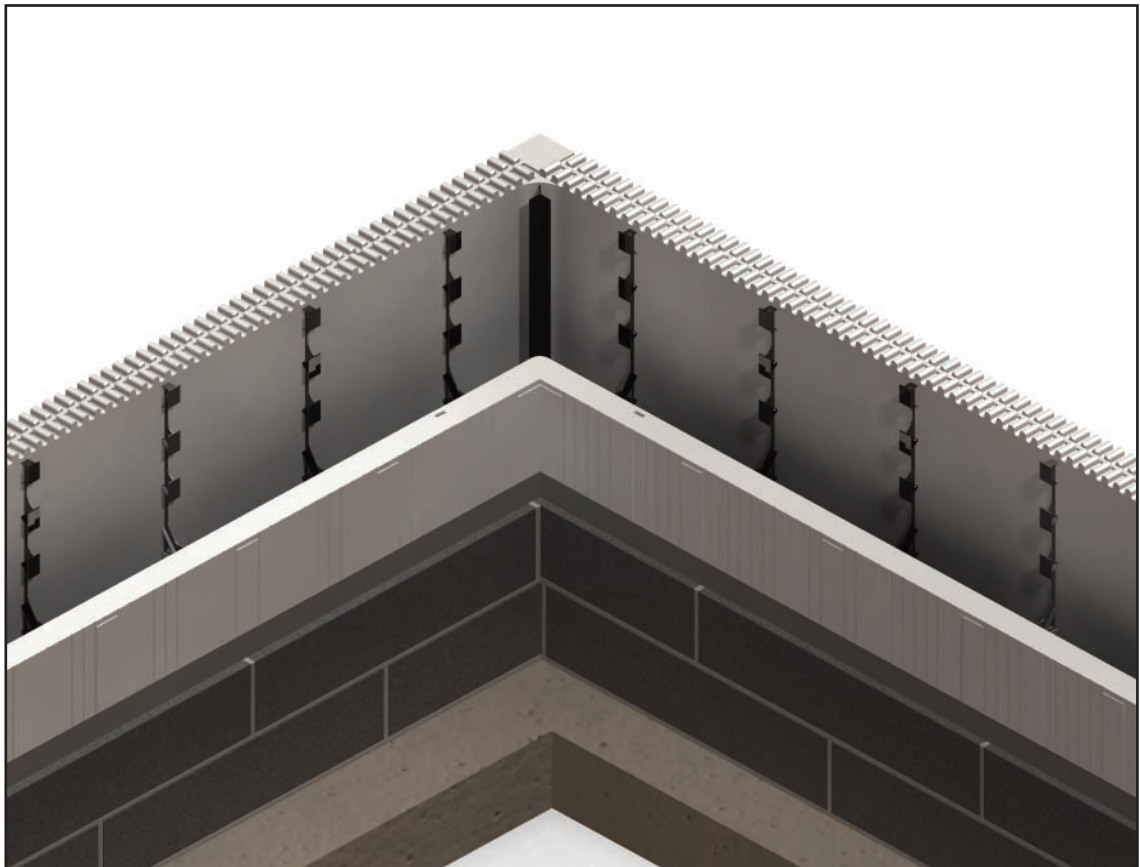


Fig 21 - Placing the FloorForms from the corner out

Once the FloorForms are installed and secured (with screws) to the FormLok, determine the location and position of the vents and install them. Care must be taken to liaise with the flooring contractor or supplier to ensure the correct location of the vents. Figs 22 & 23 show the telescopic vents installed prior to filling the FloorForms with concrete.

Depending upon the type of vent used, you may need to remove the outside grill and insert a piece of temporary EPS into the vent. This is to provide support to the vent during the concrete pour; don't forget the vent will be subject to nearly 3.0m of concrete pressure.



To protect the interlocking teeth, it is recommended that FormLok is used on the FloorForm. This will stop the interlocking teeth from being damaged as the floor is constructed.



If the vent is made of a brittle material, consider a galvanised metal 'bridge' to cover the vent, with the bridge resting on the concrete corbal.

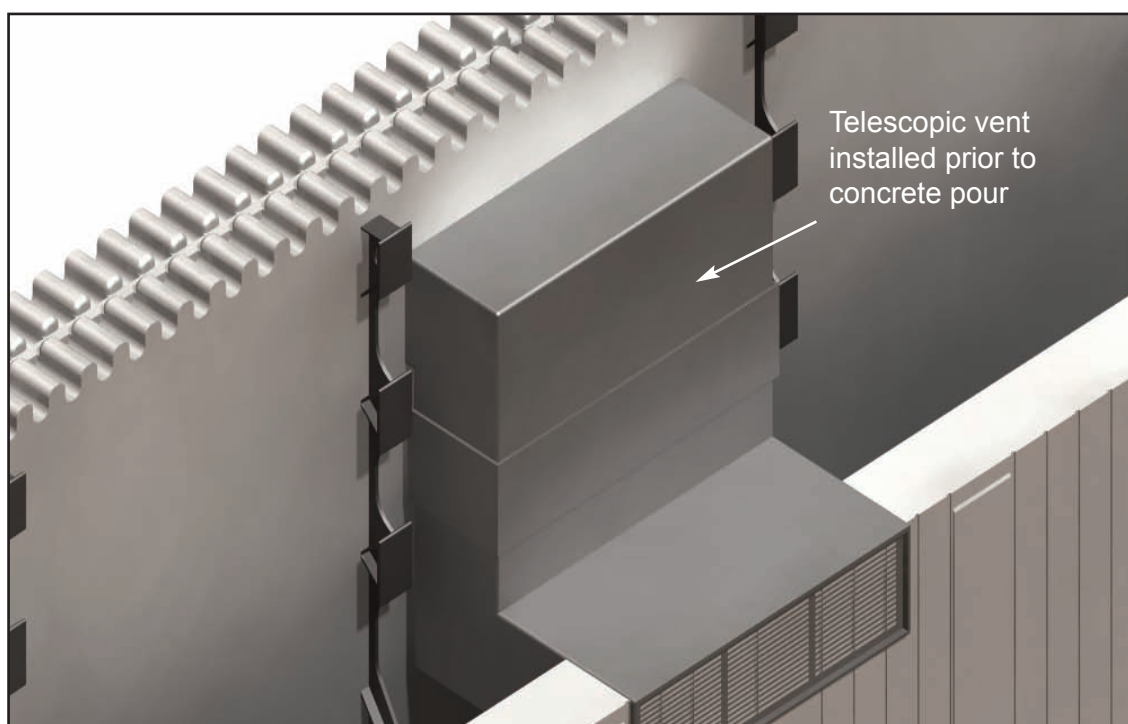


Fig 22 - Detail of telescopic vent installation

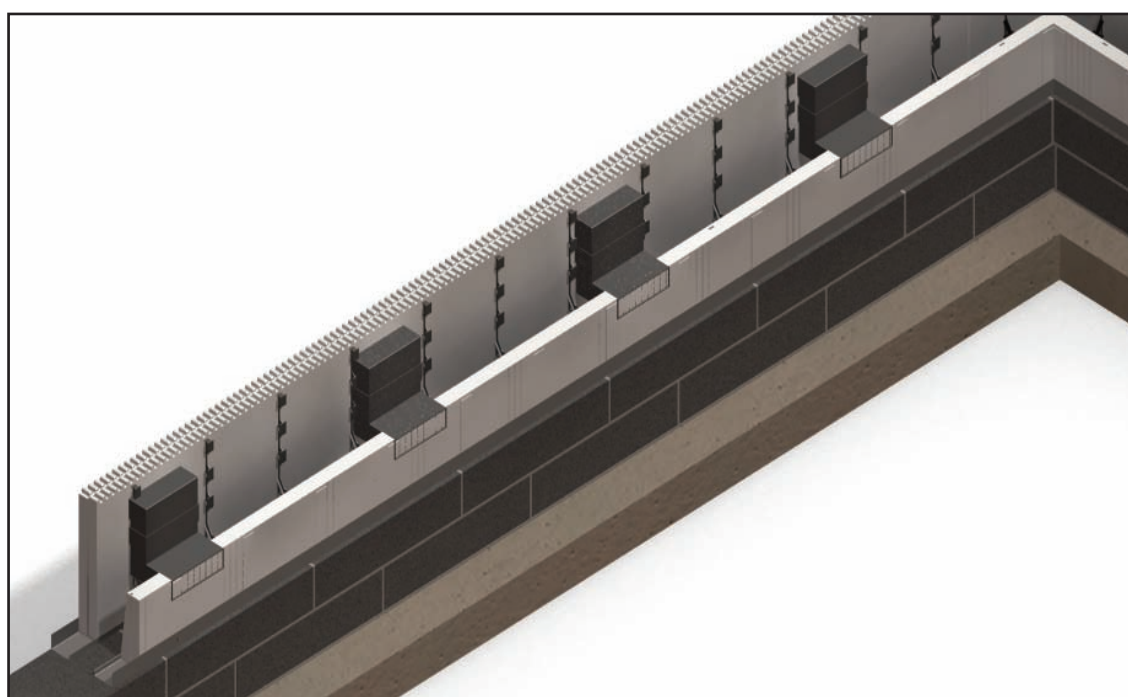


Fig 23 - Telescopic vents installed ready for the beams to be placed



Ensure that the correct spacing is used for the vents. Typical spacings are every 1800 (max 2000) - check building control and regulation requirements.



Although shown applied to the concrete corbal, it is common to apply the DPC material on the strip foundation or trench block before placing the FloorForm.

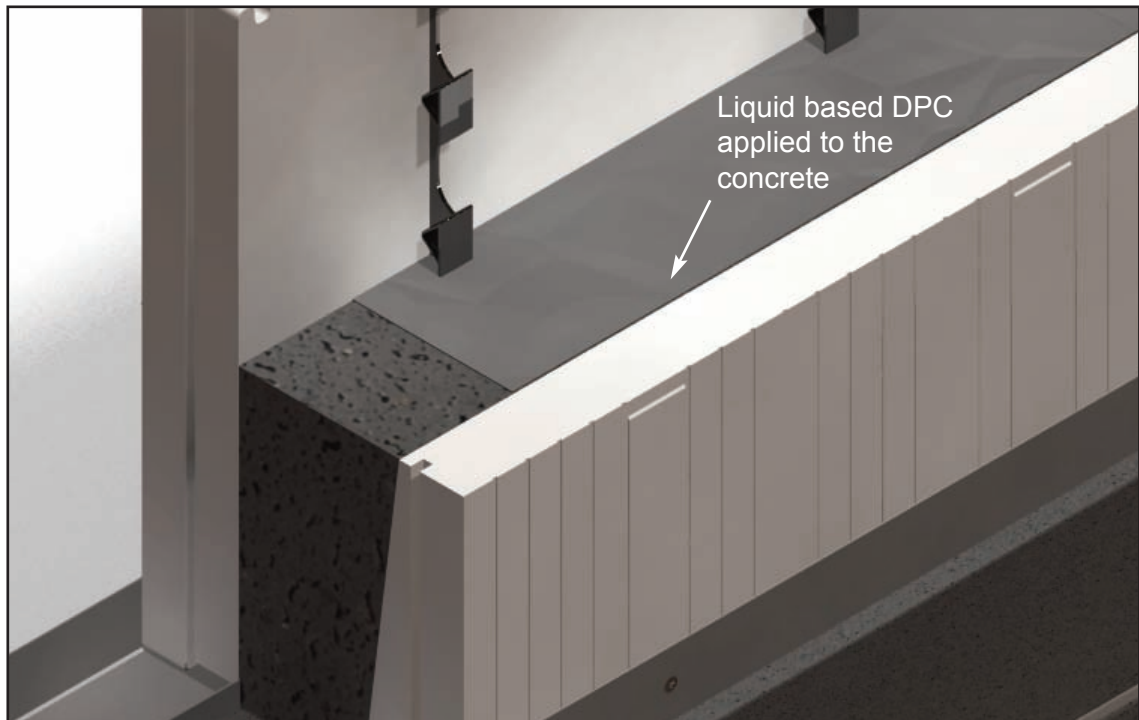


Fig 24 - Detail of liquid DPC

If you have chosen to use a waterproof concrete, then simply pour this into the forms up to the level of the ledge of the FloorForm. However, if you decide to provide a physical DPC, we recommend a liquid (not solvent based) Damp Proof Membrane (DPM) is applied to the concrete surface and then a sheet Damp Proof Course (DPC) such as Hyload is placed beneath the Floor Beams if these have been specified. The beams can now be installed (Fig 25).

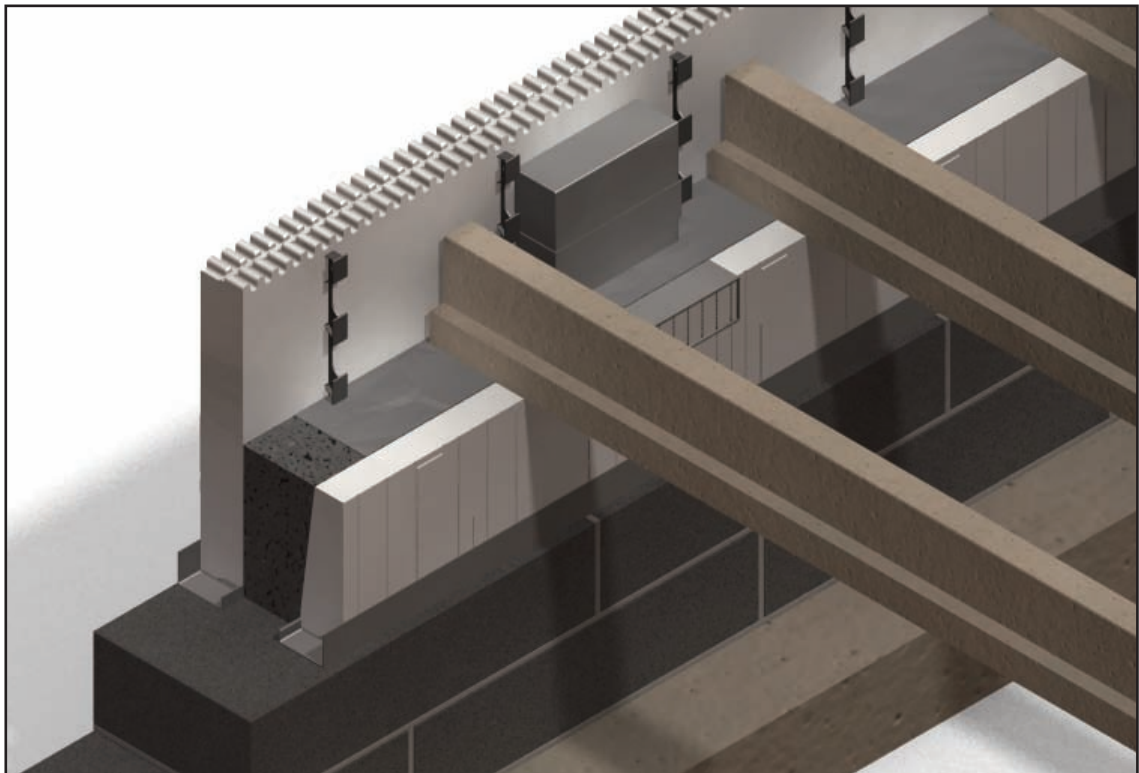


Fig 25 - Beams being installed

Once the beams are in place, the blocks can be quickly laid and bonded and then the floor is ready for the next lift.

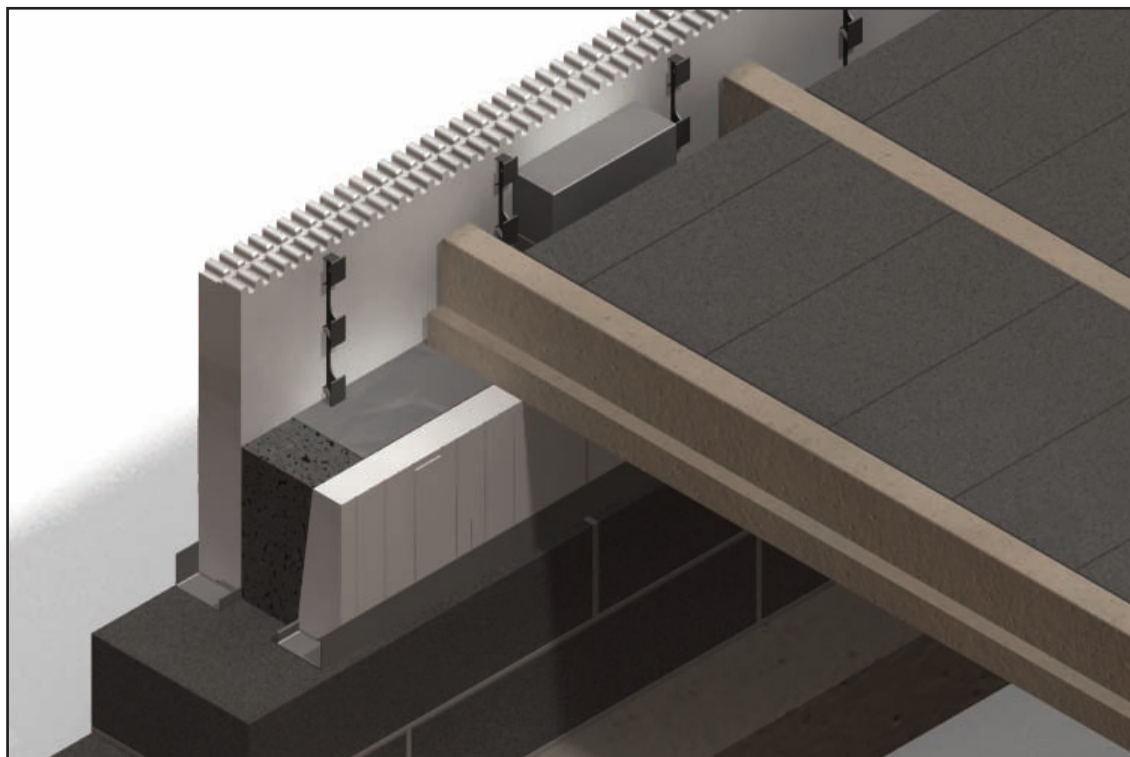


Fig 26 - Beams and block floor ready for the next lift of forms

3.5 FORM PLACEMENT - From Ground Floor

The manner in which the ICF wall is installed from this level will be the same for each subsequent floor, differing only if timber or concrete intermediate floors are used. If concrete intermediate floors are used, then the last course of forms will be FloorForms and if a timber intermediate floor is used, the last course will be HouseForm, or WallForm depending upon the structural nature of the wall and how many storeys the scheme has.

For this example we will assume that the house is built with intermediate timber floors. Now that the beam and block floor is bonded, the next operation is to affix the FormLok in place. The FormLok jig can be used to speed this operation (Fig 17, p16), making sure that it is properly secured as you go along.

Once the FormLok is in place, you will need to determine the height of the Single Interlock Raising Piece (SIRP). This is simply achieved by using a spirit level and rule; place the level on the outside interlock of the FloorForm and a rule on the top of the FormLok (Fig 27). Using this figure you can now cut the SIRP to the correct thickness so that the interlocks from the FloorForm will align with the next course of forms. It is as simple as that. Cutting with the block buddy will speed the process up as the guides can be set to the same height making multiple cuts quick and easy.

Use the Single Interlock Raising Piece Internal Corner (SIRPIC) and place this in the corner and work your way around the wall (Fig 28). Once this stage is complete you are ready to commence laying the first course of forms, again starting from the Corners and working your way around the wall (Figs 29 & 30).

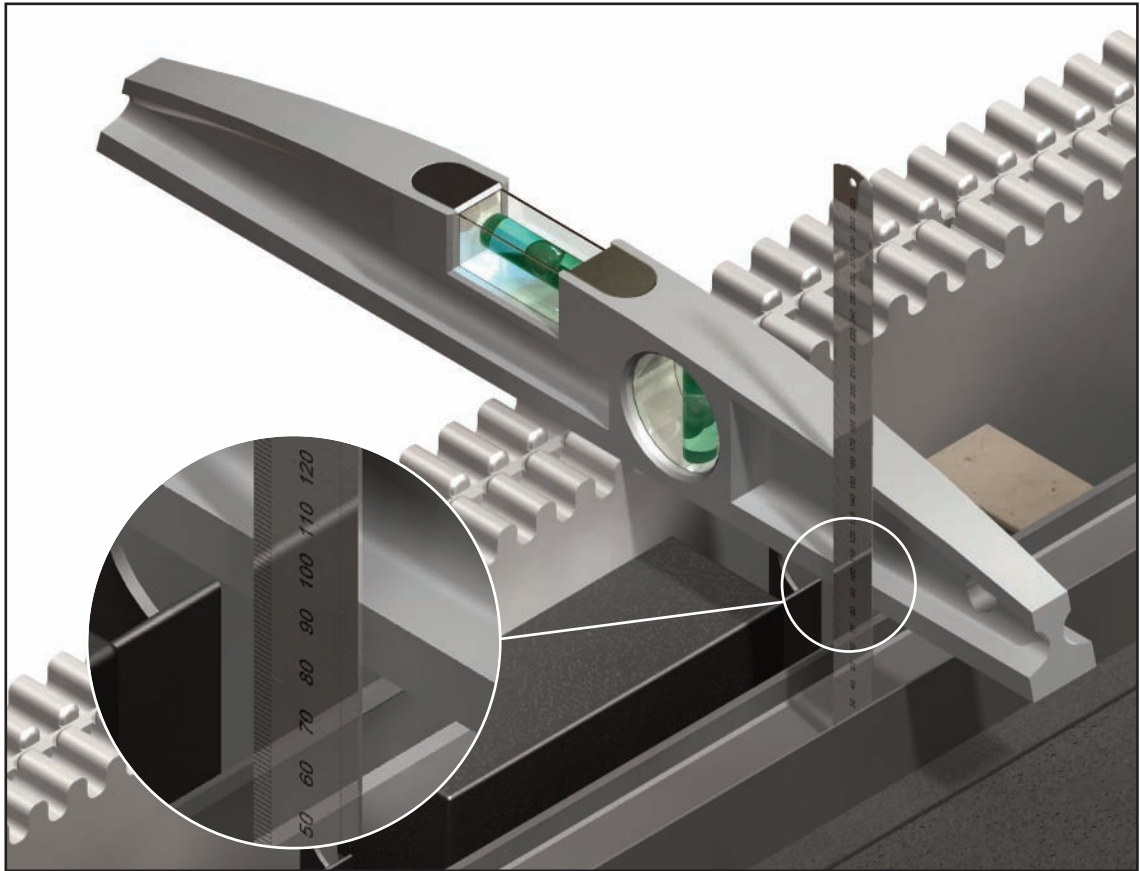


Fig 27 - Determining the height of the SIRP

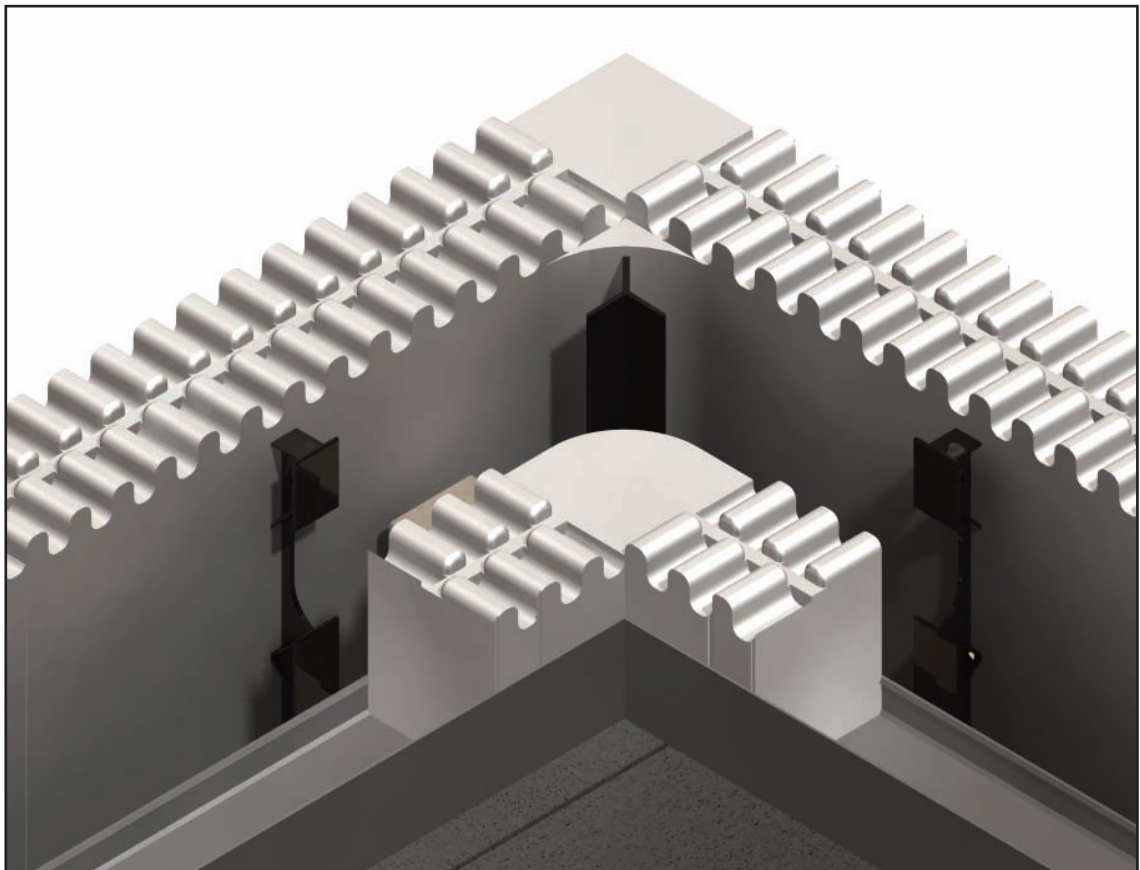


Fig 28 - SIRPIC in place

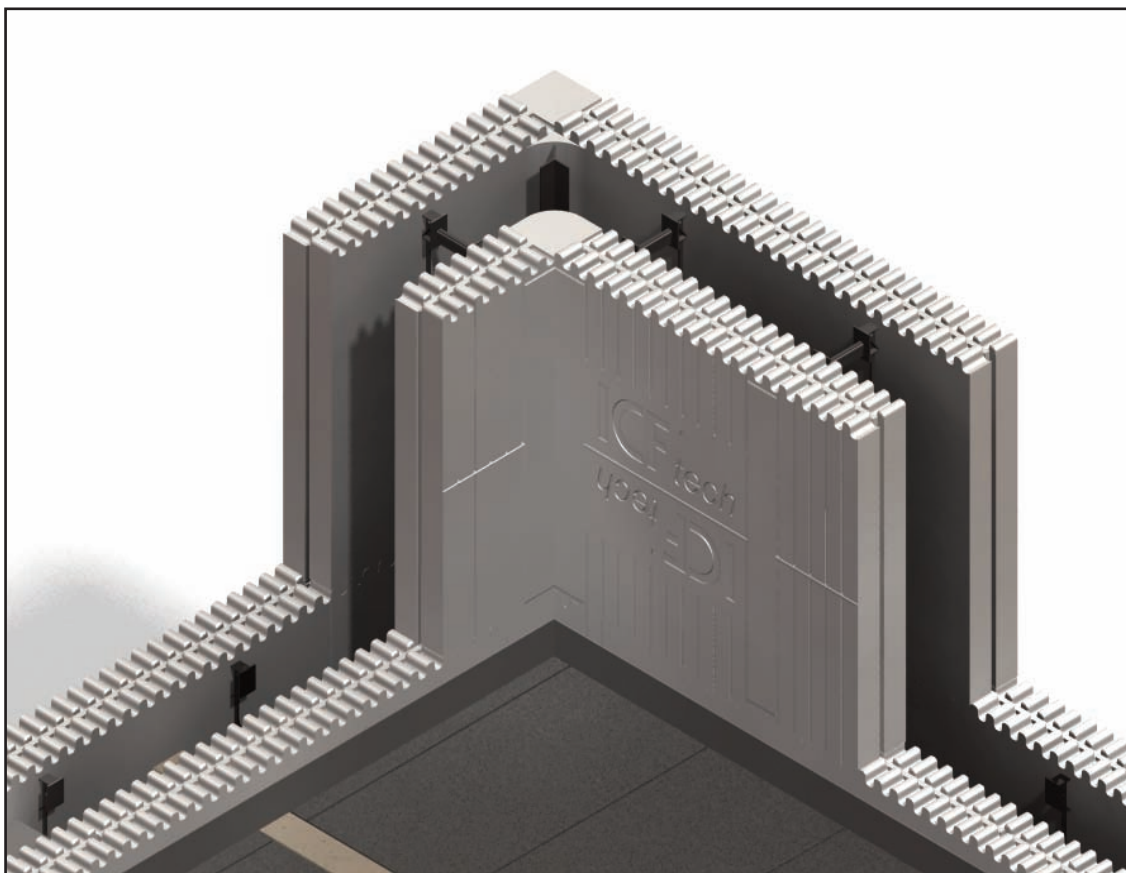


Fig 29 - SIRPs installed and corner form installed

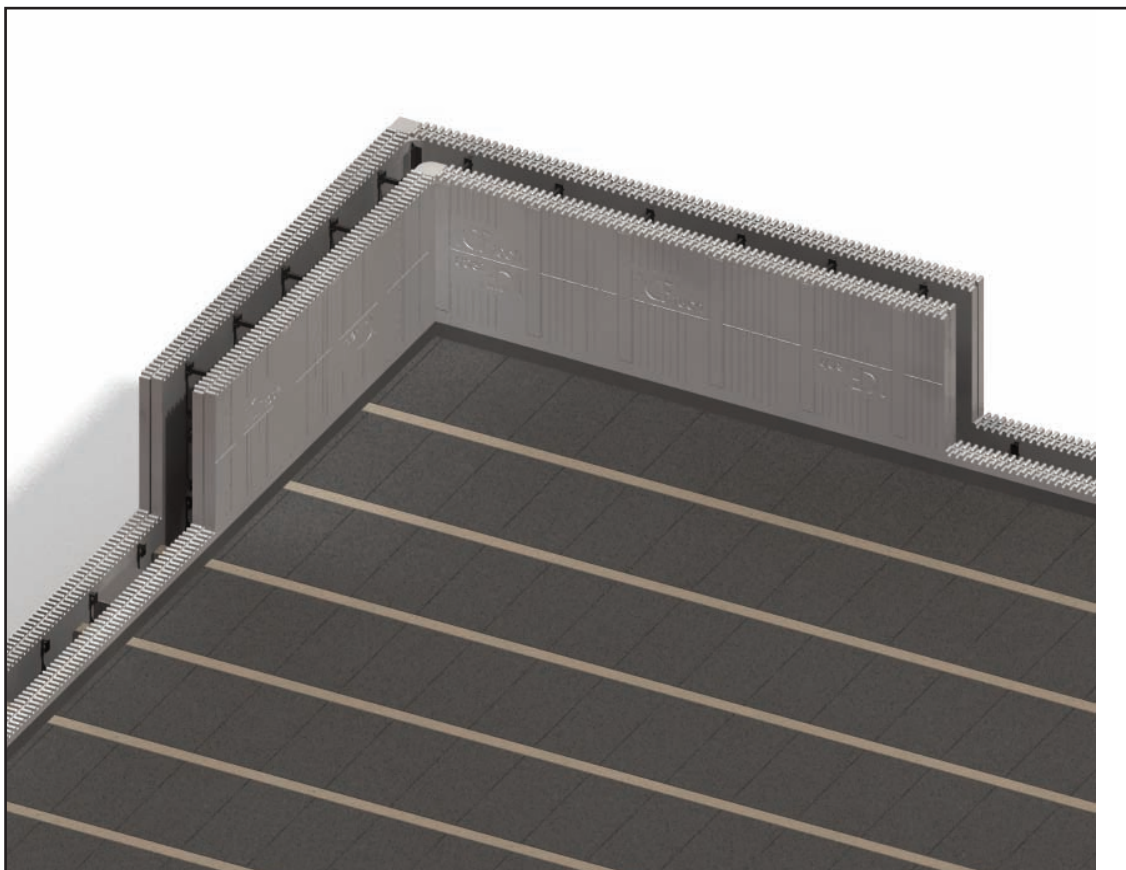


Fig 30 - Straight forms installed away from the corner form



When cutting forms, always place the off-cuts in such a way that they can be used elsewhere. Any waste EPS should be bagged and arrangements made for it to be collected for recycling.



When cutting EPS with a hot knife, ensure that there is adequate ventilation as small amounts of pentane may be released. Pentane is a ZODP.



It is best practise to lay the blocks from left to right so that all cuts are in the same position making it easier to keep an eye on any reinforcement of the cut forms.

3.51 Rebar Placement

As the wall progresses there may be a requirement to place horizontal and vertical rebar, depending on the structural requirements of the wall. Generally, the HouseForm requires H10 rebar at every 1200mm vertically (600mm from corners) and at the 2nd, 4th and 6th courses. This is very easily placed as the wall is built. Care should be taken to ensure that the correct overlap splice is maintained. As a rule of thumb, the splice overlap should be 40 times the rebar thickness, please refer to section 4, Principles of Reinforcement.

Fig. 31 shows how the rebar is located in the webs (EPS panel removed for clarity) and fig 32 shows how a splice is installed using loop-end twisting wire; the correct overlap splice is not shown. At corners, a bent section of H10 rebar is used and this should normally be 500mm x 500mm to allow for splicing.



It is good practise to bend tie wire downwards away from walls to ensure wire has maximum concrete cover and is not resting on the EPS skin, or closer than 25mm, as this can cause rusting of the wire.



Fig 31 - Detail of rebar located in the web



Fig 32 - Detail of rebar overlap-splice

As you move from corner to corner, mark the floor roughly where window openings are as this acts as a useful aide memoir as the wall is installed. When you need to cut a form, always make sure that cuts DO NOT line up, i.e. in the same place on consecutive courses. This will cause a weakness; if it is totally unavoidable, use a piece of 9mm ply to span between the webs of the cut form and the one adjacent to it (figs 33 & 34).



Fig 33 - Diagram showing where cut forms should NOT be positioned

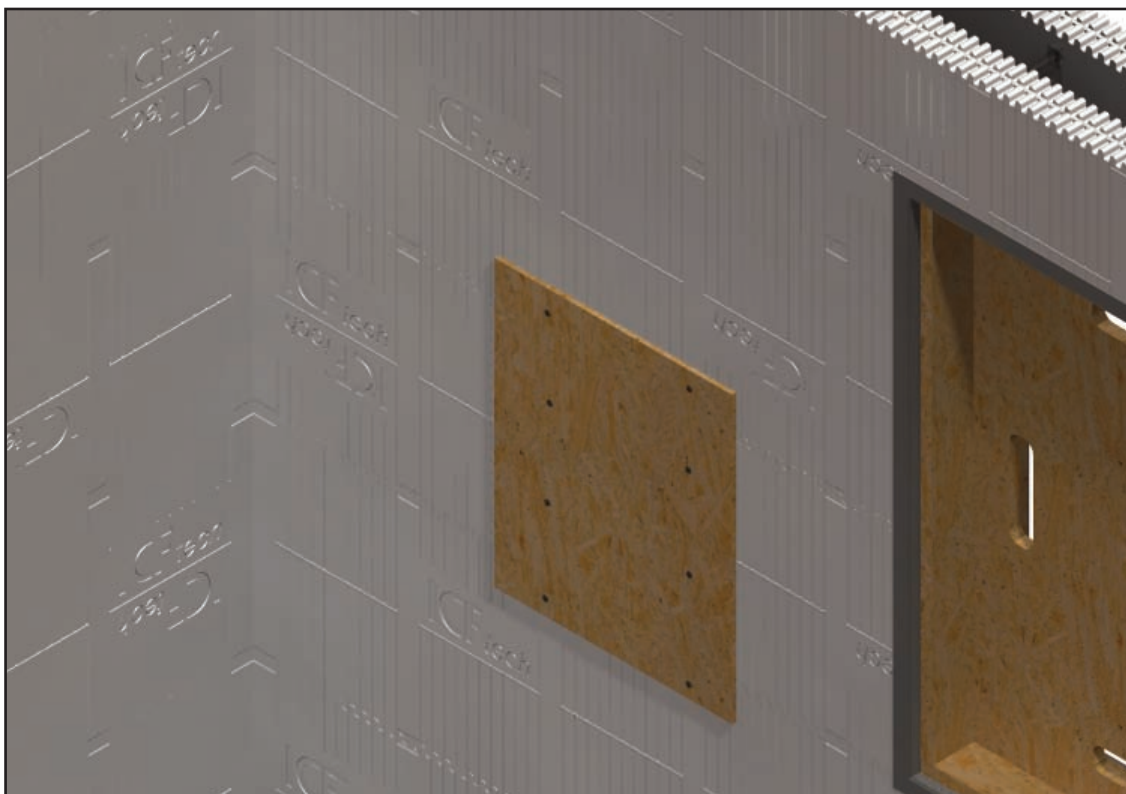


Fig 34 - 9mm ply used to reinforce cut form



Remember to place cut ends of Forms above each other on consecutive courses to ensure firing pieces are vertically aligned. As mentioned previously, cuts are normally to the right-hand side and normally above third course due to openings.



Remember to drill 12mm holes through the cill area at 150mm c/c's to ensure that air is not trapped beneath the FormCloser whilst the concrete is being poured – once concrete is seen to emerge from these holes, they can be sealed using our hole plugs.



The diagram is simplified to aid recognition of the key components. In reality the bracing would return around corners and provision is required to support the ends of the planks. This can be easily achieved by securing a piece of timber into the webs at the end of a run and resting the ends of the planks on this timber, securing with screws.

3.52 Bracing and alignment system

In order to ensure that the ICF Tech wall remains plumb whilst consecutive courses are placed and during concrete pouring, it is necessary to use our Bracing and Alignment System (B&A). After placing the third course of Forms, it is necessary to start positioning the B & A system around the inside perimeter of the wall.

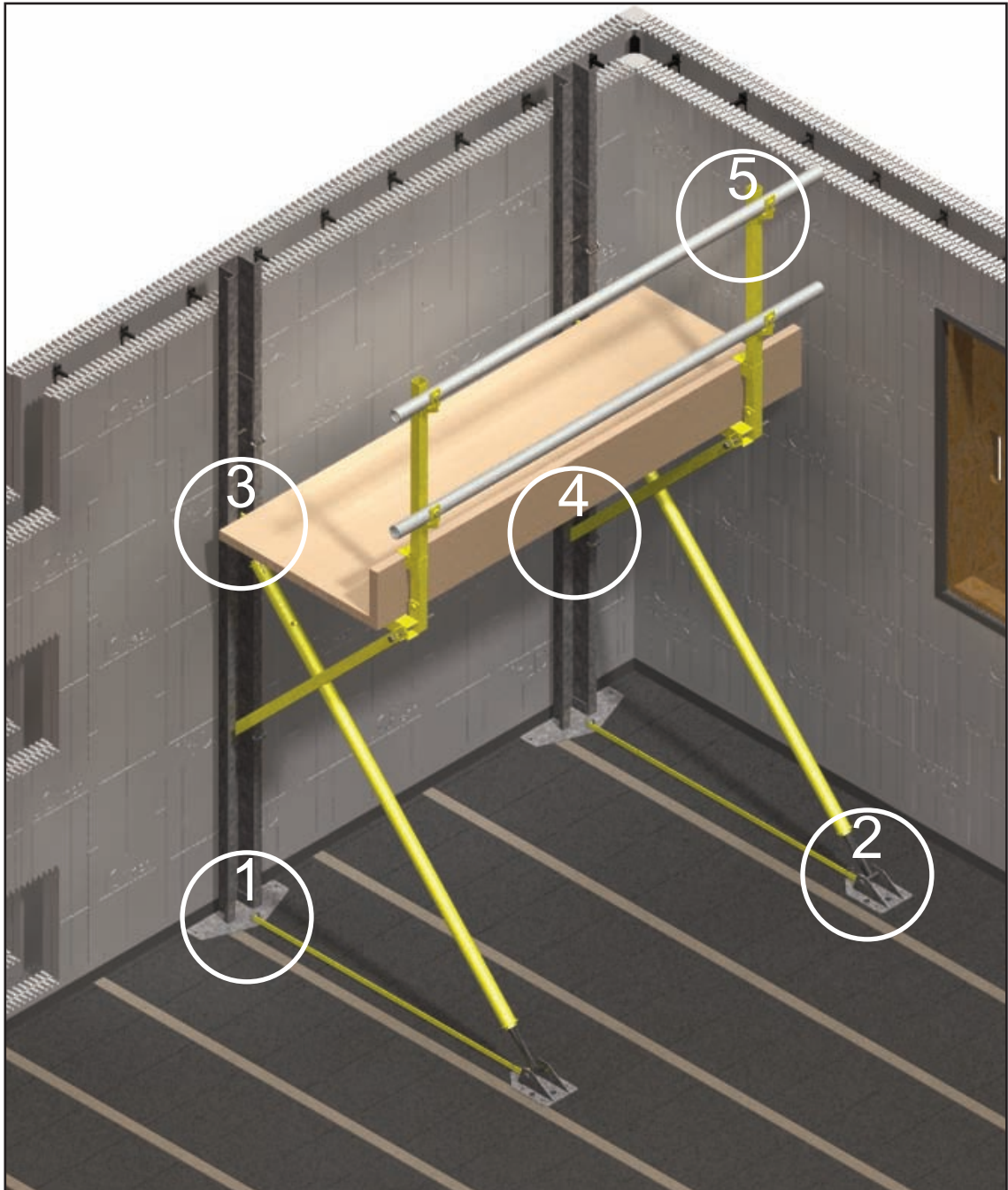


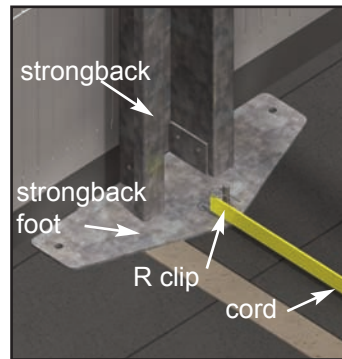
Fig 35 - Detail of Bracing & Alignment system installed

Our B&A system has been designed to both brace the wall and keep it plumb during concrete pouring, but also has a working platform whilst the wall and its constituent parts are being installed. During the concrete pour, the B&A system acts as a secure anchor to attach 'fall arrest systems' which we recommend as good practice whilst working at height.

1

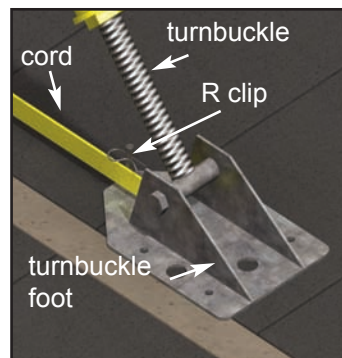
The first operation is to place the strongback against the wall at the correct distances apart. The B&A's should not be placed further apart than 1200mm or the nearest web position before this distance.

Do not fix the strongback foot to the floor at this stage, wait until the Turnbuckle assembly has been positioned and secured.



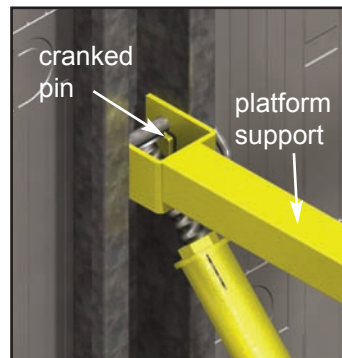
2

The Turnbuckle should be offered up to the Strongback and the securing pin attached (see 3). The Strongback Cord can now be placed over the locating pins, one at the Strongback Foot and the other at the Turnbuckle Foot. Place the two 'R' Clips in place. Make sure that the Strongback Foot is correctly placed against the wall and use T30 7.5x52 concrete screws to secure both feet to the concrete. Check for level.



3

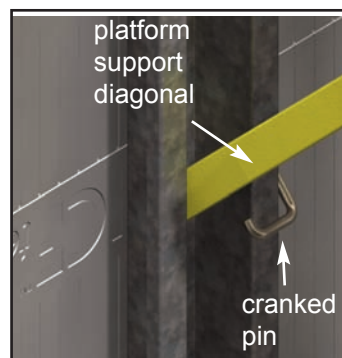
Now that the Strongback Foot and the Turnbuckle foot have been secured to the concrete, attach the Platform Assembly. This is best done by attaching the Platform Support Tube on to the Strongback Cranked Pin. The fixing mechanism ensures that the Platform Support cannot come out once the assembly is in place. Attach the Platform Diagonal to the lower fixing point (4) using the Cranked Pin provided.



4

The Handrail Support Tube should be left down at this stage to make it easier to place the wooden platform.

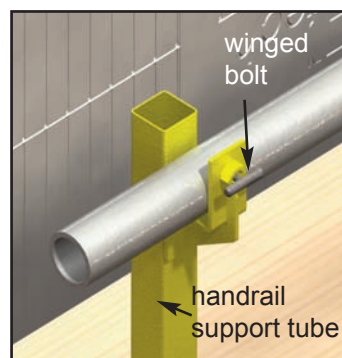
The B&A system should now be adjusted so that the Strongbacks are plumb. Once this has been completed, fix the Strongback to the ICF wall using SPAX SP pan head 4x50 screws. Now the working platform can be put in place and the Handrail Assembly fixed.



5

With the Working Platform in place, fix the Handrail Tubes in place ensuring that the winged bolt is screwed-in sufficiently to stop the tube pulling out of its support, but not too tight to hinder dis-assembly.

With the working platform now in place, check the Strongback once more to ensure that they remain plumb. You are now ready for the next courses.



Make sure that when you offer the Strongback to the wall, and initially attach the Turnbuckle, that the top of the Strongback is not touching the wall. If so, adjust the Turnbuckle until the Strongback is clear of the wall.



The Strongback comes in a standard length of 2000mm. An extension piece which is 500mm long should be added to secure the last course (sixth) to the Strongback. Attached using a cranked pin.

As described earlier, the B&A system is designed to provide a safe working platform whilst working at height. To ensure the safety of the ICF installer the use of a Fall Restraint System (FRS) is considered essential once the building increase in height or were any risk of injury from falling is considered likely during risk assessments.

The Fall FRS utilises a lanyard with a large karabiner that attaches to the hand rail. The Lanyard is in turn attached to a fixing point on the rear of the harness; this provides 2.15 m of movement in either direction from the fixing point. The karabiner will move freely between the Handrail Support Uprights. This will give the operative just over 5m of working space before having to re-attach the karabiner to another section of handrail.



3.53 FormCloser Placement

Our Patented FormCloser system allows openings to be formed in our ICF walls without resorting to crude lengths of timber, or relying on off-cuts of EPS to seal the gap around the opening. The FormCloser provides a fixing solution for the window or door frames from the interior of the building and ensures insulation continuity due to its insulated core. This is achieved by using a clip system. The clips are screwed to the window and as the window is pushed into place, the clips locate in special grooves in the FormCloser. The groove positions allow for 'check', 'semi-check' or 'flush' window positions (Fig 36.)

The FormCloser can be purchased ready-formed or can be formed on-site with reverse-mitre joints. Whichever method is chosen, it is simply a matter of building the wall up either side of the opening, cutting the Forms course by course to suit, placing the reinforcement below and to the sides of the opening, and finally placing the cut head-Forms over the head of the FormCloser. If using a site-formed FormCloser, use strips of self-adhesive fibreglass tape to temporarily fix the FormCloser back to the Forms, ideally at 300mm centres. When cutting the Forms to accommodate the FormCloser, remember to allow 4mm either side for the thickness of the FormCloser and a fixing tolerance, normally 10mm for the opening size of the FormCloser.

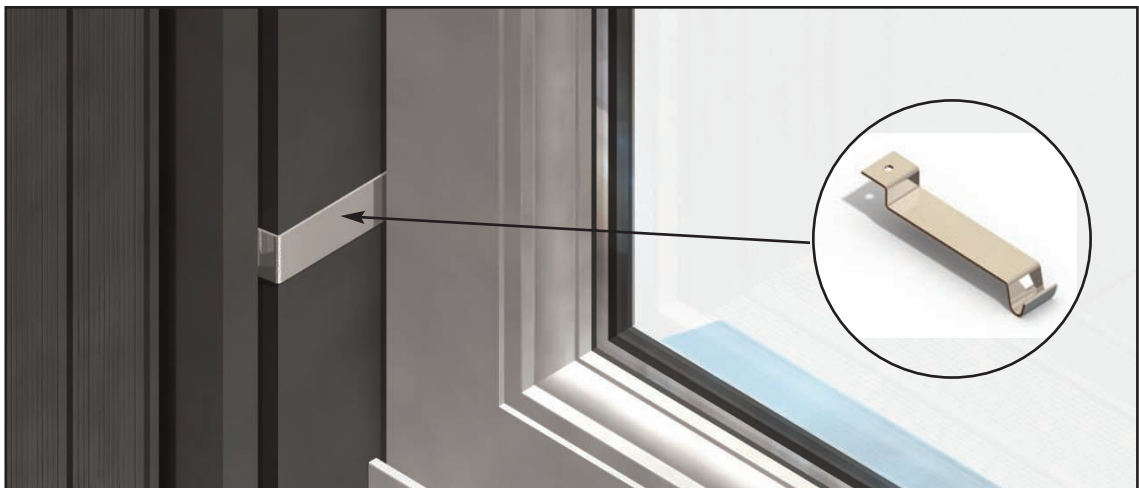


Fig 36 - Detail of window clip

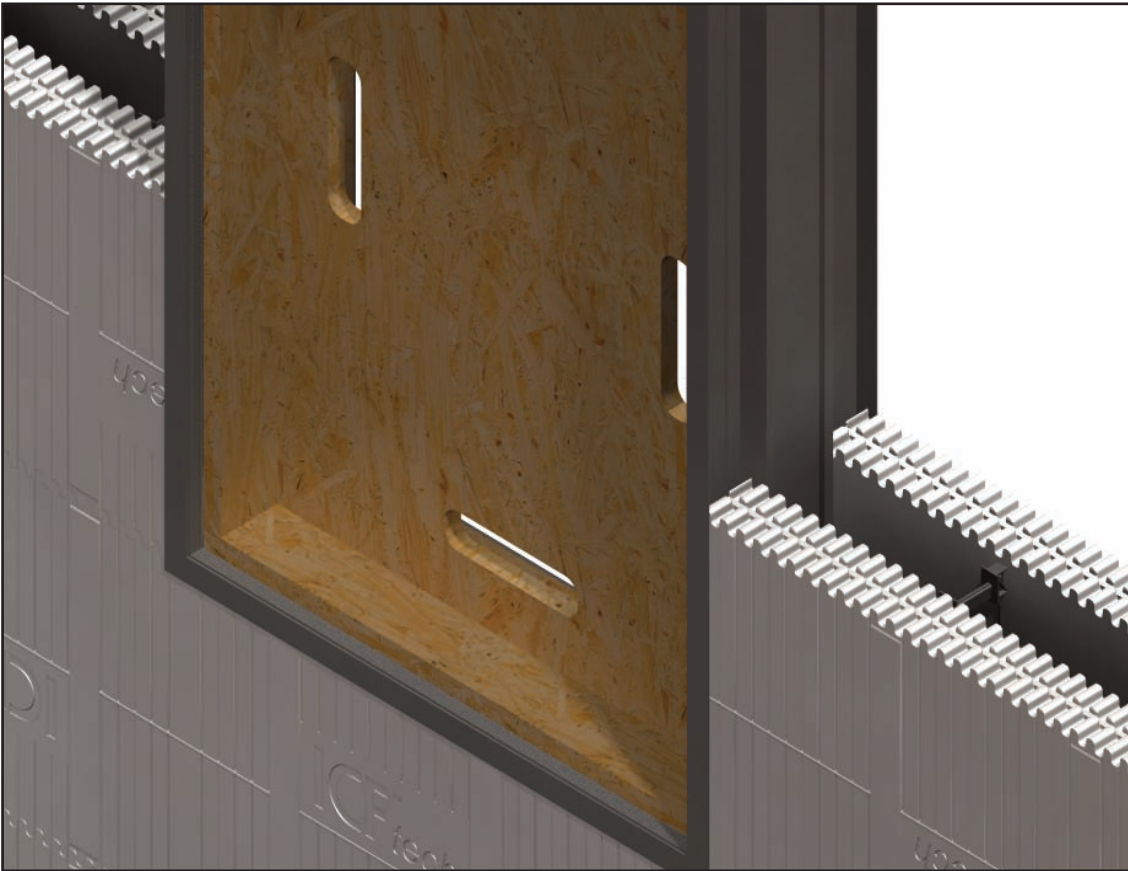


Fig 37 - FormCloser being installed as ICF wall is erected



Fig 38 - FormCloser with bracing and vent holes

3.54 Lintols over and around openings

Our Rebar cradle was designed to offer a simple method of creating lintels over structural openings. By simply clipping the rebar cradles into the back of our FormCloser and referring to our reinforcement table. Lintols can be formed without the use of special lintel Blocks, as with other ICF's.

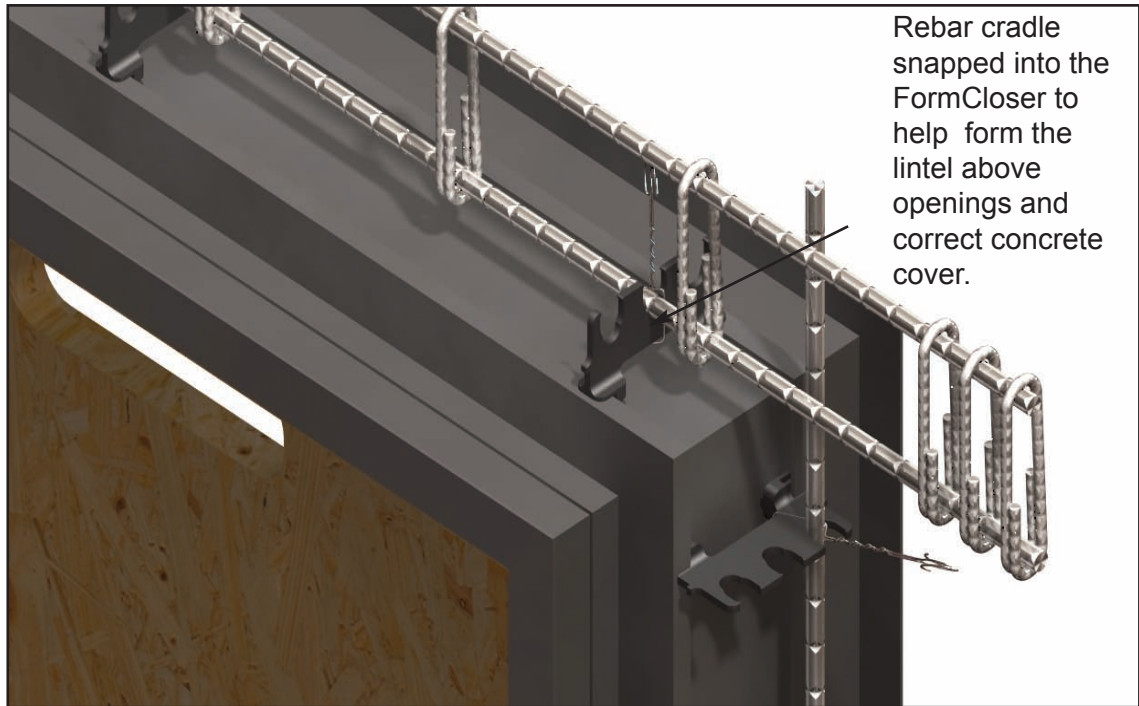


Fig 39 - Detail at the top of the window to show FormCloser, rebar cradle and rebar lintol

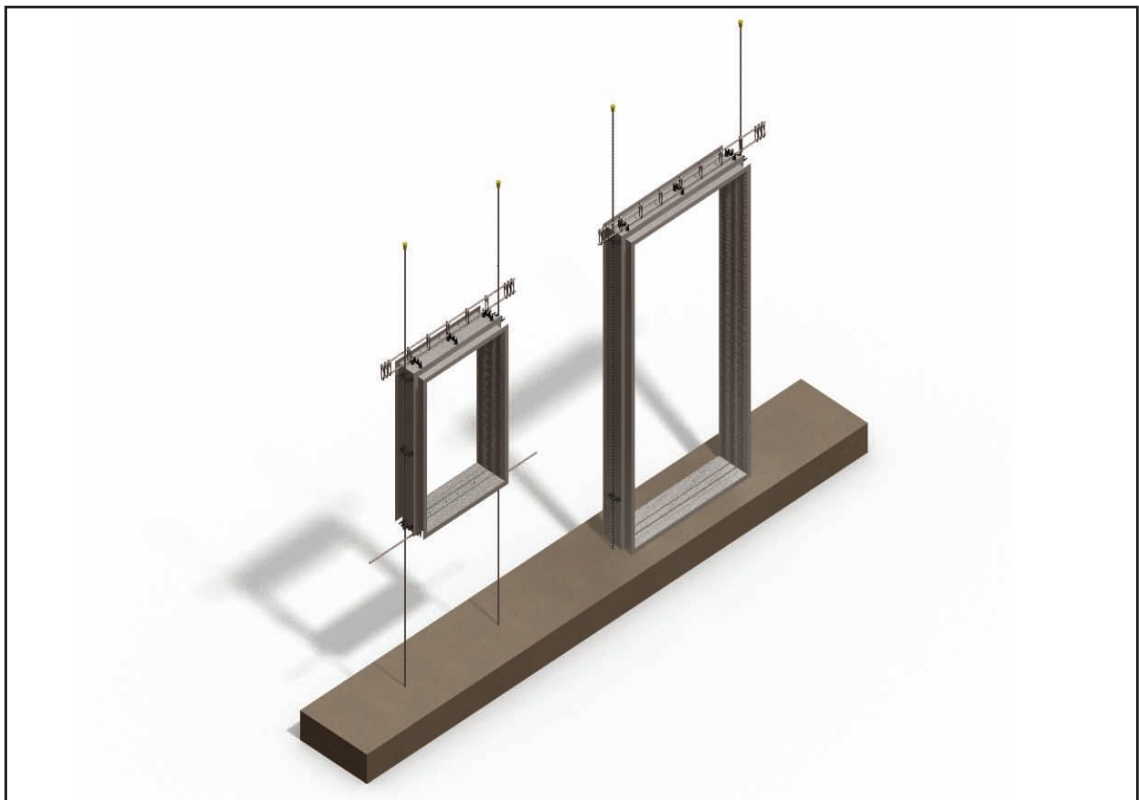


Fig 40 - Typical rebar placement around openings

3.55 Simpson Strongtie Ledger Placement

The floor ledger is a simple metal pressing which allows the quick attachment of timber floors to our walling system without the need for set-in threaded bar, which is both hazardous and difficult to install and level. The Floor ledger can also be used vertically to provide structural fixing points for internal walls.

Spacing for the Floor Ledger will depend upon the loading requirements for the designed floor, which are easily established by reference to Simpson Strongtie literature or following the example below in fig 41 taken from our estimating software.

How many FloorLedgers?				
You need to determine the combined floor load, end point reactions and use the span and centre information from the flooring solution to determine the total end point reaction				
Multiply the end point reaction by the no. of joists to give total end point reaction. Divide this figure by the safe loading figure and this gives the quantity.				
End Point Reaction = <u>Span (m) x Joist Centres x Floor Load</u>		No. =	<u>Total end point reaction</u>	input required
2			<u>Safe load (strongtie)</u>	
From timber floor data	floor span	5100		
	joist C/C	400		
	Load	2.72 kN/m2 (live load + dead load + partition load)		
	2.77 Kn end point reaction			
	18 joists (bearing length/centres)			
	7.3 safe load (from Strongtie data sheet)			
	50 Total end point reaction			
	6925 Bearing wall length			
	7.00 Ledgers (per side + allow extra for the two side perimeter beams - 1 every 2m)			
	900 Spacing			

Fig 41 - Example of loading calculation to determine the no. of ledgers

The installation of the Ledger is straight forward. Our Bracing and Alignment system has a removable top-section from the Strongback, specifically to allow the placement of the Floor Ledger and the forming of the next floor, prior to striking the Bracing and Alignment System.

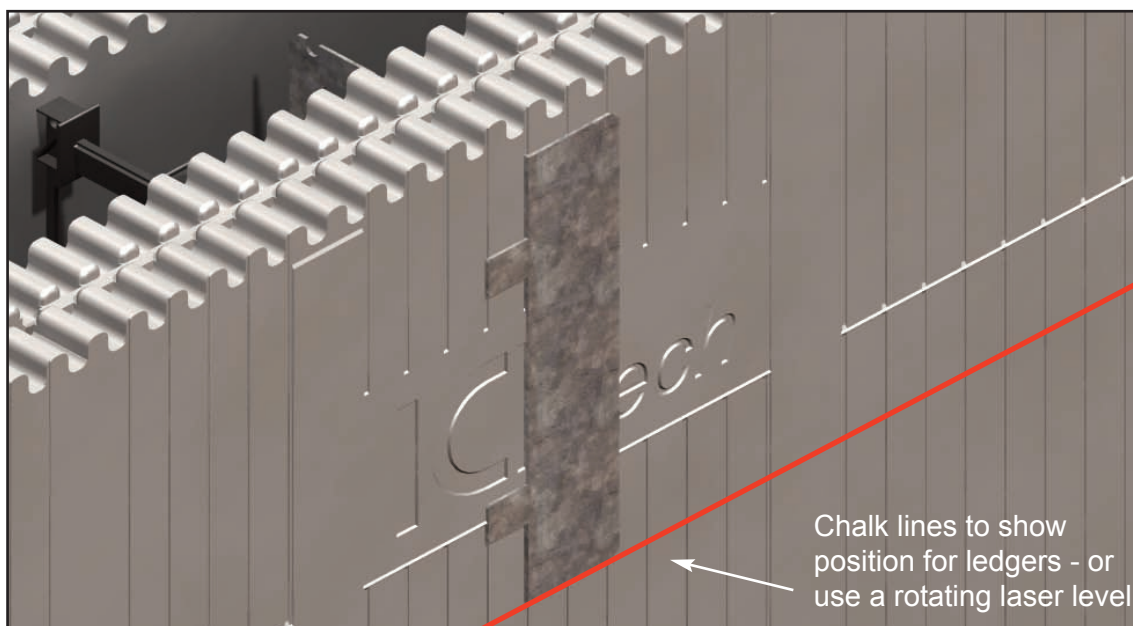


Fig 42 - Floor Ledger inserted into the Form ready for the concrete core to be filled

Once the correct spacing is known, simply snap a chalk line to indicate the top of joist and cut a vertical slot 290mm high x 3mm wide (kerf) into the ICF Wall and insert the Floor Ledger so that it protrudes into the ICF cavity once the flat face of the Ledger is resting against the face of the ICF Wall. If the Floor Ledger is loose, simply apply a small amount of fixing foam to temporarily secure in place.

Depending on the loadings, small lengths of rebar can be slotted into the top and bottom holes of FloorLedger within the Form Cavity to provide additional strength.

Once the concrete has been poured, encasing the floor ledger within the ICF wall cavity and the concrete has gained sufficient early strength (minimum 24 hours for Bardon Concrete ICF mix, a timber ledger of the same cross-section as the intended floor joists is fixed to the exposed face of the floor ledger using Cladfix ASF38 5.5x70mm No.3 pt. self-tapping hexagon-headed zinc-coated screws positioned c/c's 75mm vertical and 20mm horizontal, as per Fig 43.

Joist hangers can then be used to fix the floor joists perpendicular to the timber ledger at the design Spacing.

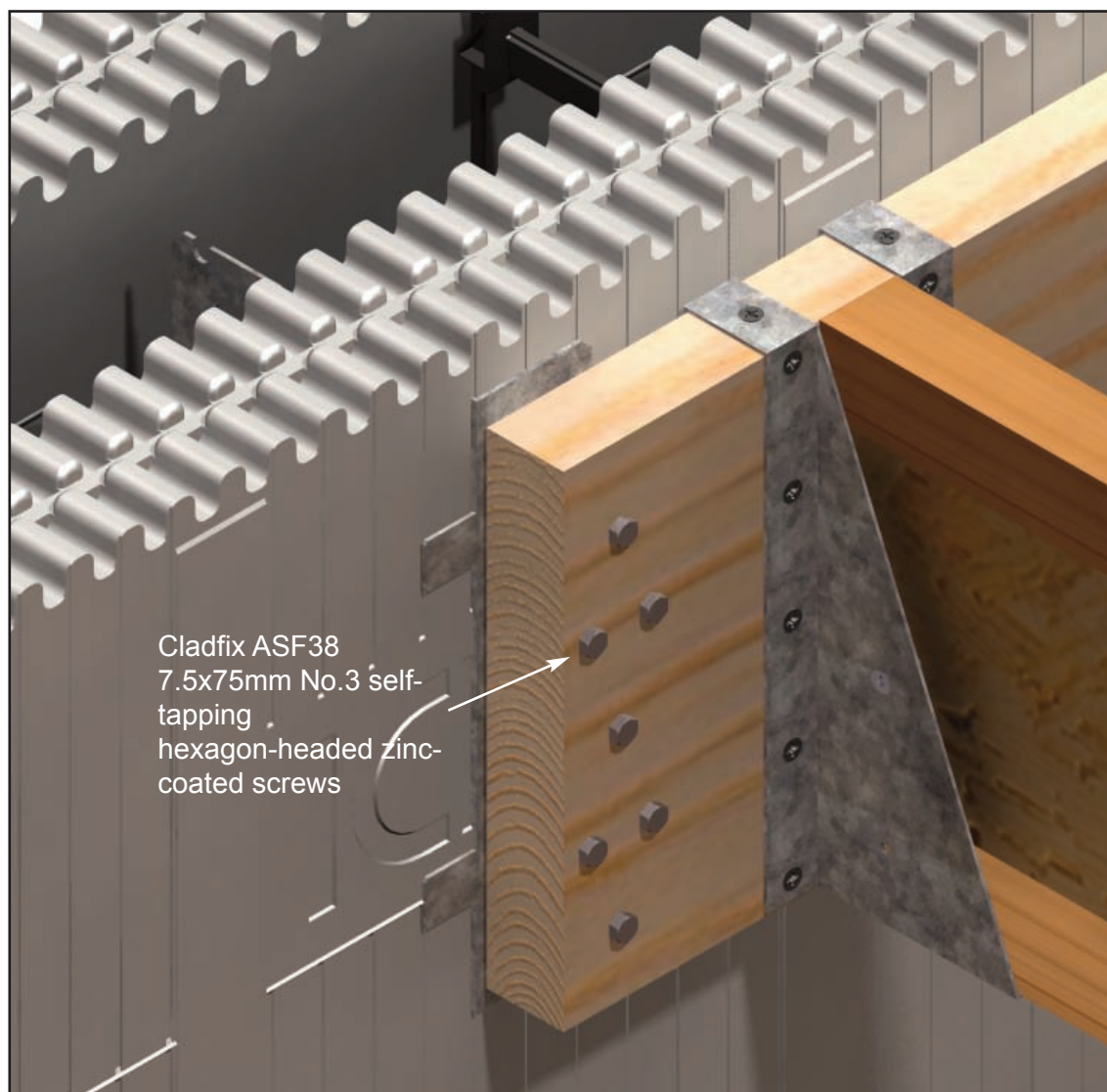


Fig 43 FloorLedger detail showing fixing screws

All the differing types of timber floor can be fixed using this system, be it a MiTek composite joist, TJI joist, or even cassette floors, so long as the appropriate joist hanger and noggin details are adhered to. A steel angle is used in place of the timber ledger when using a cassette floor system, as detailed below.

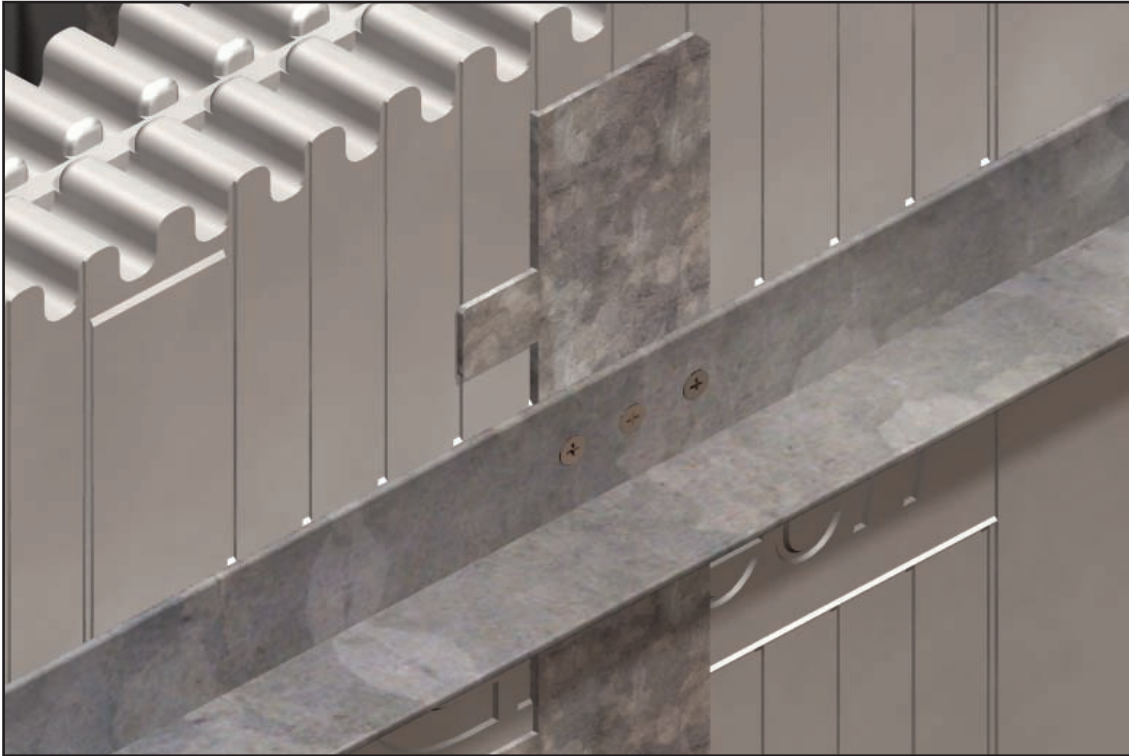


Fig 44 - Detail of fixing arrangement when using cassette floor systems



Use a section of FormLok to protect the Form interlock in the areas where the concrete pouring is taking place. This will avoid time-consuming cleaning of the interlock later.



Use of the Pre-Concrete Pour Checklist is advised at this point. See appendix



Ensure that a first aid kit is available that includes an eye wash station. Do not work in clothes that have become coated in concrete.



Ensure there is 9mm ply available, cut into 600x900 sheets in case there is a blow-out.

3.6 CONCRETE PLACEMENT

Prior to placing the concrete in the ICF wall, re-check that all fixings for the Bracing and Alignment (B&A) system are secure and that the B&A system is still plumb, using the Turnbuckle to adjust if necessary.

Concrete placement takes place once the ICF wall has reached the desired height (usually 6 courses + maximum 2 coursing blocks) and the B&A system has been erected and fixings checked. Although our self-levelling ICF Concrete mix can be theoretically poured from one/two positions, we recommend that the operative responsible for placing the concrete, places concrete along the perimeter of the wall to be filled. This should be done so that the level of the fill remains roughly even around the wall, allowing the pressures to be absorbed into the ICF wall.

It is also sensible to protect the interlock teeth from concrete spillage by either using 4" tape or FormLok, This will save time and frustration as you prepare for the next course.

The use of a concrete pump is a practical solution for getting the concrete to the pouring point and it is essential that an OD hose of max. 100mm be used with a 75mm velocity reducer fitted to ensure an uneventful and clean pour. Pumps can be either mounted onto the concrete delivery lorry, be self-propelled units or of the trailer-type.

Always use protective clothing, including High Visibility jacket, hard hat, goggles and waterproof gloves when handling concrete due to the corrosive nature of cement. Always wash-off concrete splashes on exposed skin as soon as practicable, If concrete slurry has gone into the eyes, stop the pour immediately and seek medical attention.

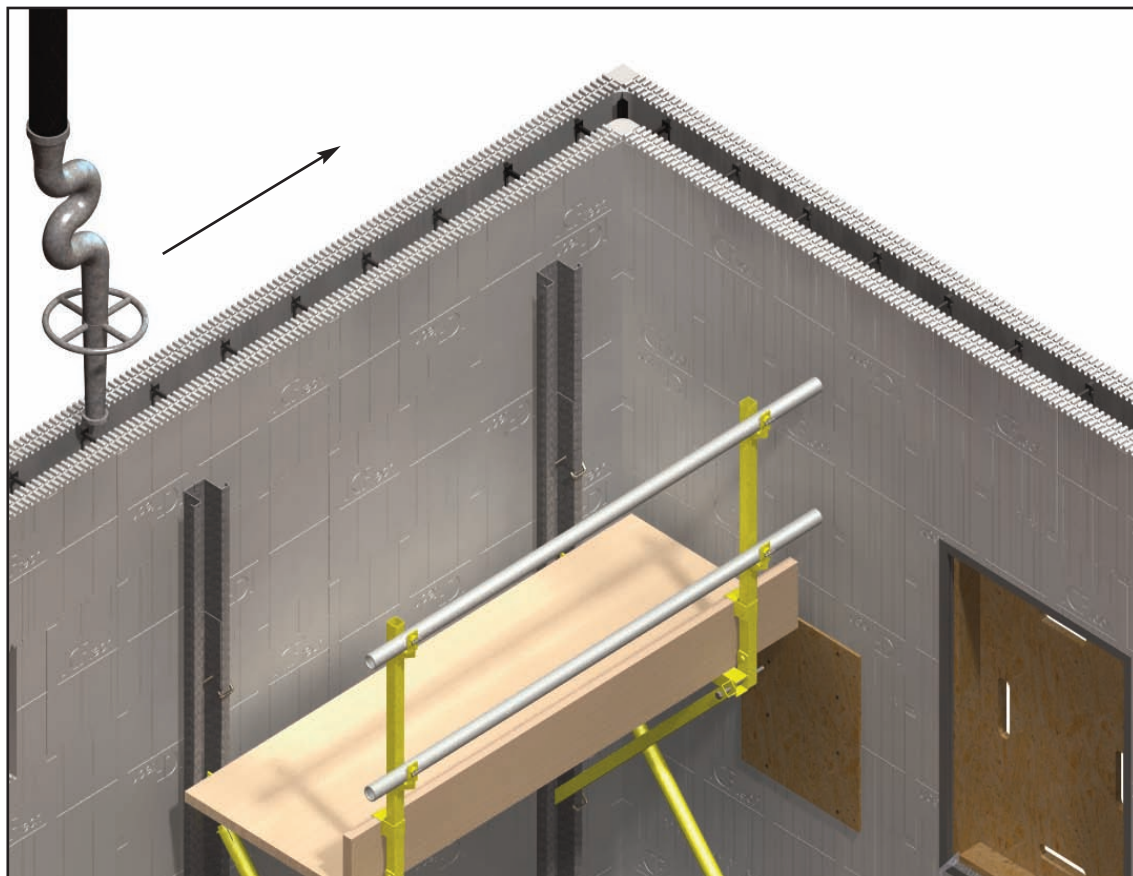


Fig 45 - Concrete pouring using a double S reducer

3.61 Concrete Boom Pumps

Most of our concrete will be placed using a concrete boom pump for concrete placement via the top of the wall. The first point to consider, and perhaps the most important, is the velocity that the concrete is pumped at. Modern pumps can vary the pump rate, but the way in which the boom is configured is also important to reduce the velocity still further. Also, try and choose a pump that has remote control via wire or preferably wireless; this ensures that the installer has full control over the concrete pour.

The reduction in velocity via the boom configuration is achieved by ensuring that the boom lengths (normally three) are configured in a series of 45 deg bends so that the last boom section, before the flexible hose, is pointing upwards.

It is also important to ensure that at the delivery end, the hose is connected to a delivery head that incorporates two 'S' bends (see Fig 45, preferably with sturdy handles and a shut-off plate), thereby further reducing the concrete velocity. If the pump has only a native five inch (5") outlet to the boom, reducers must be fitted to ensure that the flexible hose remains a minimum four inch (4") pipe.

Grease the rubber seals and collars used to fit the reducing bends, and slacken-off the collar, as this will allow the assembly to rotate and aid placement. Ensure that all delivery hoses are properly cleaned and slightly oiled (e.g. WD40).

3.62 Bottom-up pump

Work and experimentation is still on-going for this unique way (in the ICF industry) of filling the walls from the bottom-up. As work progresses, ICF Tech will keep you informed of the progress of this innovation.

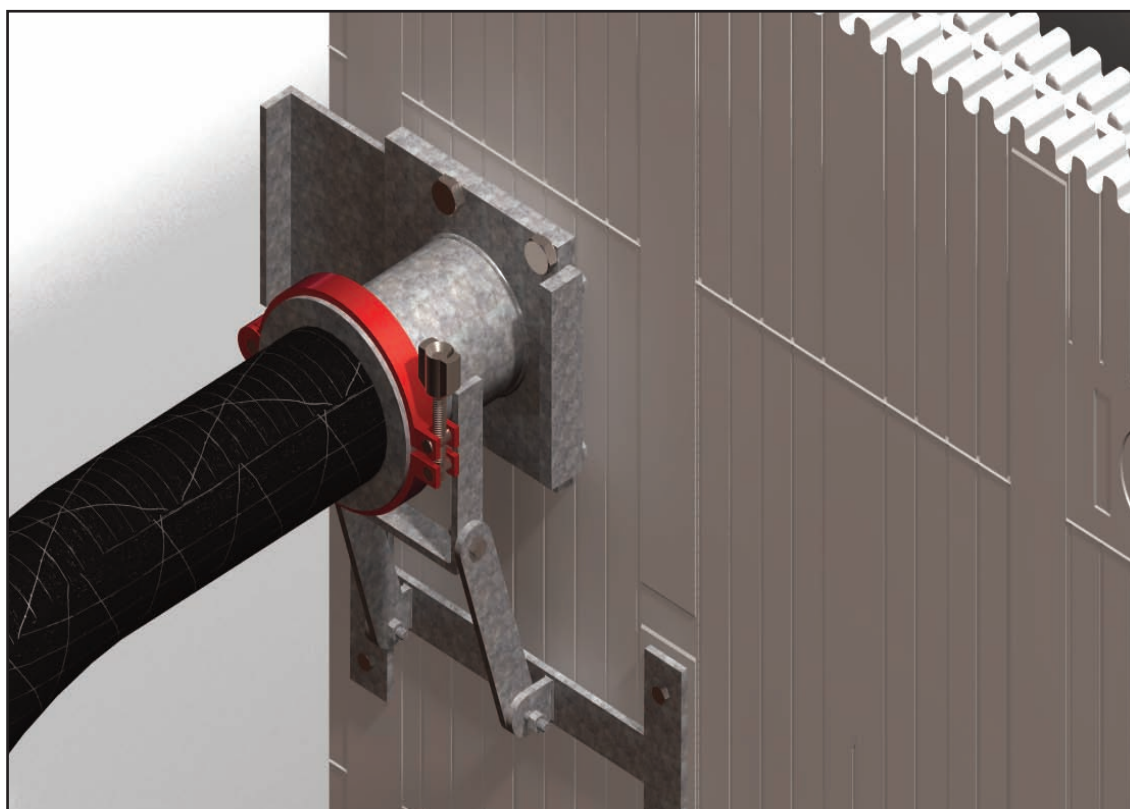


Fig 46 - Bottom-up pump assembly



Always ensure that you order two (2) bags of Ordinary Portland Cement (OPC) to lubricate the pump prior to concrete pour. This is not normally supplied by the pump contractor.



Avoid pouring over lintels when pouring a run of wall - if this occurs, make sure the rebar is cleared of concrete as this may harden over the period of pour and prevent concrete passing through - causing a void.



Remember to allow an extra 1/2m³ of concrete to account for concrete that will be lost in the pump lines during wash-out.



This checklist will be part of a site QA procedure and will be kept as a record of the completed contract

3.63 Pre-concrete pour checklist

CONSTRUCTION LEVEL:

DATE:

COMPLETED BY:

CONTRACT:

- ☐ Have all service ducts been placed and sealed and at the correct level?
- ☐ Have forms been fixed to FormLok?
- ☐ Has all vertical and horizontal rebar been placed and fixed securely?
- ☐ Have window and door openings been sufficiently braced?
- ☐ Are all window and door openings in the correct position and height?
- ☐ Have vent holes been drilled in the bottom section of all FormClosers used in openings?
- ☐ Is the Bracing and Alignment (B&A) system properly erected and plumb with access ladders fixed securely?
- ☐ Has the pressure washer been placed ready for post-pour cleaning?
- ☐ Are all scaffold planks, kickboards and handrails in place, secured and free from obstruction?
- ☐ Has the FloorLedger been installed (if required) and has it been checked for position and alignment?
- ☐ Have any wall plates been cut to size and drilled (if required)?
- ☐ Are starter bars required and if so, have they been installed?
- ☐ Has FormLok been installed where required and has interlock protection tape been applied?
- ☐ Has access for pump and concrete lorry been agreed and accepted?
- ☐ Is there sufficient OPC to prime the pump - has a wash-out and surplus concrete area been designated?
- ☐ Have void vents been reinforced using cut EPS in the outside void?
- ☐ Have all weak points been properly reinforced with 9mm ply?

3.64 Post-concrete pour checklist

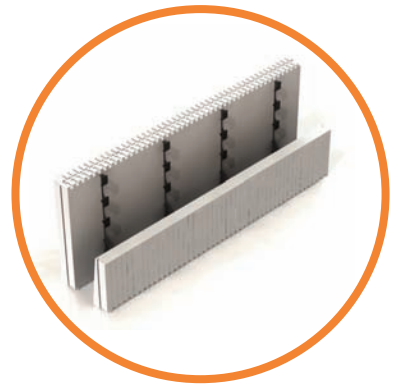
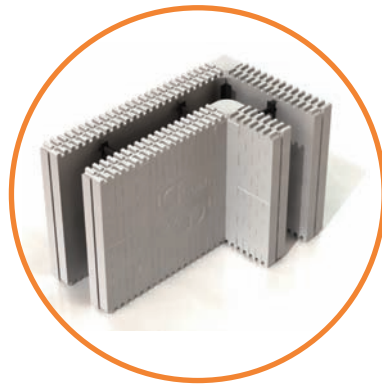
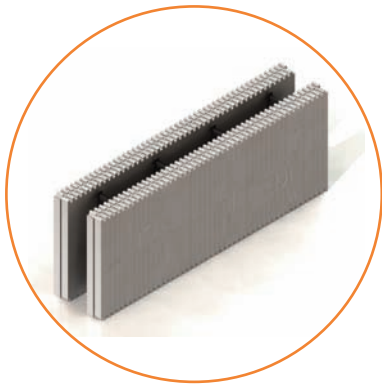


This checklist will be part of a site QA procedure and will be kept as a record of the completed contract.

CONSTRUCTION LEVEL:		
DATE:	COMPLETED BY:	CONTRACT:

- ☐ Is the wall straight and plumb?
- ☐ If at wall plate level, has the plate been fixed?
- ☐ Have all holes in FormClosers been checked and plugged?
- ☐ Have all spillages been cleaned up?
- ☐ Are there any leaks around service duct penetrations?
- ☐ Have any floor Ledgers been dislodged?
- ☐ Have all tools been cleaned?
- ☐ Has the Bracing & Alignment System moved?
- ☐ Has the wall been checked AGAIN for level?
- ☐ Are all scaffold planks/kickboards and hand rail secure?
- ☐ Have all the pump hoses and reducers, clamps and seals been properly cleaned and lightly oiled?

Again, this is not meant to cover all aspects of construction using our High Performance Walling System and common sense should dictate other checks if the construction has deviated from the principles here before-mentioned.



4

Principles of reinforcement

4 Principles of reinforcement



Remember to leave the correct Lap Splice length protruding from the top of the form if vertical reinforcement is required in the next lift and to use a plastic sleeve as previously described.



Ensure that any exposed rebar has the appropriate rebar cap in place to prevent injury.



All reinforcement is galvanised.
All reinforcement to be located centrally within wall.

4.1 Spliced joints in reinforced concrete

If there is a requirement for reinforcement, it is important to understand the principles of how the metal reinforcement bars are joined together, as reinforcement is typically supplied in lengths not exceeding 6.1m. Unless you intend to weld each rebar to the next, which we do not recommend, the bars will need to be joined, which means they will need to be lapped also.

The LAP Length is derived from the following formula which will provide the minimum amount of material length;

Length lap = 40 times the rebar diameter, OR

Length lap = 40d (where d is the diameter of the bar being spliced)

Once this is ascertained, you can then consider which type of joint you are going to use.

These joints are commonly referred to as LAP SPLICES and can be either;

- » Non-Contact Lap Splices where the rebars are allowed to be separated by up to 1/5 of the bar lap length to a maximum of 150mm, OR
- » Contact Lap Splices where the rebars must be secured together.

We recommend the use of the Contact Splice in our HouseForm to ensure that the joint does not interfere with the free flow of the concrete, during the pour. The joint can be formed with tying wire, using a Yankee Twister to easily twist the wire together, or proprietary splice joints can be used which house both ends of the rebar, locking them in place with an Allen Key arrangement.

Non-Contact Splices are useful where Starter bars have been designed into the foundation strip. It is common to use a plastic sleeve which is inserted into the foundation around the protruding Starter bars as the concrete sets. This makes it easy to locate the vertical rebar and form the Non-Contact splice. Depending on the height of the wall, it is sometimes easier to place the vertical rebar just before the concrete pour

4.2 Rebar placement

Generally: Reinforcement will be detailed by project engineer in accordance with Eurocode 2, although we have standard details which apply in most situations when using Bardon Concrete's self-compacting foamed concrete, as follows;

Plain wall with no or minimal openings (e.g. gable or party wall)

- » Provide one central vertical H10 bar
- » Provide one vertical H10 bar 600mm in from each corner (internal)
- » Provide vertical H10 bars at 1200mm intervals either side of the central bar
- » When the distance between last of these 1200mm spaced bars and the bar 600mm in from the corner is less than 2400, (e.g. 1900mm), then one vertical bar should be located centrally to this section of wall (i.e. 950/950mm)
- » Vertical bars should extend the full height of the pour, or, where there will be another pour on top of the current one, 500mm past the height of pour to provide continuity into the next pour
- » Continuity bars should be located at 1200mm centres max.
- » A horizontal bar should be located in web cradle of of the first form of every pour height, continuous round the building, or in the course below the windows
- » Overlap by 400mm where necessary for continuity
- » A horizontal bar should be located to line up with the bottom of the lintels, continuous round the building. Overlap by 400mm where necessary for continuity.

Wall with several openings - Reinforcement around openings

Where an elevation has multiple openings the windows will break up the above reinforcement pattern. Therefore start with opening reinforcement as follows:

- » Lintel truss to be set out with the internal stirrup bar hitting the top chord of the truss centrally over the opening
- » Lintel truss design taken from tables. Generally stirrup is one size smaller than top / bottom chord
- » **Up to 1500mm opening:**
 - Lintels to project 450mm each side beyond the structural opening (i.e. allowing for FormCloser - opening plus closer x 2 plus 900mm)
 - H10 Horizontal bar located 75mm below window, projects 450mm past structural opening either side (as lintel)
 - H10 Vertical bar located either side of opening, running from bottom of pour to 330mm above top of lintel truss
 - H10 vertical bar from bottom of pour to horizontal reinforcement below opening positioned centrally to opening
- » **Over 1500mm wide openings:**
 - Lintels to project 750mm each side beyond structural opening (i.e. allowing for FormCloser - opening plus 2 x FormCloser plus 1500mm)
 - H10 Horizontal bar located 150mm below window, projects 750mm past structural opening either side (as lintel)
 - H10 Vertical bar located 150mm either side of opening, running from bottom of pour to 180mm above top of lintel truss
 - H10 vertical bar from bottom of pour to horizontal reinforcement below opening positioned centrally to opening



Remember to leave the correct Lap Splice length protruding from the top of the form if vertical reinforcement is required in the next lift and to use a plastic sleeve as previously described.

Wall with several openings - Reinforcement between & beyond openings

- » Provide one vertical H10 bar 600mm in from each corner
- » Provide H10 horizontal reinforcement bar creating continuity linking the bottom of lintels and the reinforcement below openings in two rows around the building
- » Provide vertical continuity reinforcement projecting 500mm into next pour centrally above each opening (not required where there is no pour above)
- » Ensure continuity reinforcement is allowed at maximum 1200mm centres
- » Between opening and any internal bracing partition provide vertical H10 reinforcement bar centrally between reinforcement provided for opening and the location of the bracing partition
- » H10 vertical bars to be provided at maximum 1200mm c/c.

Projecting extension to building (e.g. single storey utility room extension or garage)

- » Set out main building reinforcement
- » Allow H10 vertical reinforcement 600mm in from corner of extension
- » From the reinforcement 600mm in from the corner above, to the reinforcement in the extension corner, divide the wall up into 1200 bays with a vertical bar at the end of each bay, and equalise the odd dimension either side of the bays out to the corner reinforcement. e.g, 600mm in from external corner, H10 corner vertical bar, 800mm, H10 bar, 1200mm, H10 bar, 1200mm, H10 bar, 800mm, H10 corner reinforcement of main building. Horizontal reinforcement as before.

When placing the Vertical Rebar, it is easier to use 1750mm lengths, placed after the second and fourth courses have been laid, except when placing rebar over structural openings such as windows and doors; full length rebar can be used in these situations.

Vertical rebar should be tied to the horizontal rebar or to adjacent webs if practicable. When the second section of vertical rebar is placed, remember to create a spliced joint between the two vertical rebars with a minimum overlap of 40mm (40d). This will leave the correct amount of rebar protruding ready for the next floor.

4.3 STARTER BAR REINFORCEMENT

Although not always required (depending on structural loading) make sure that the placement of starter bars coincide with the spacing between the webs.

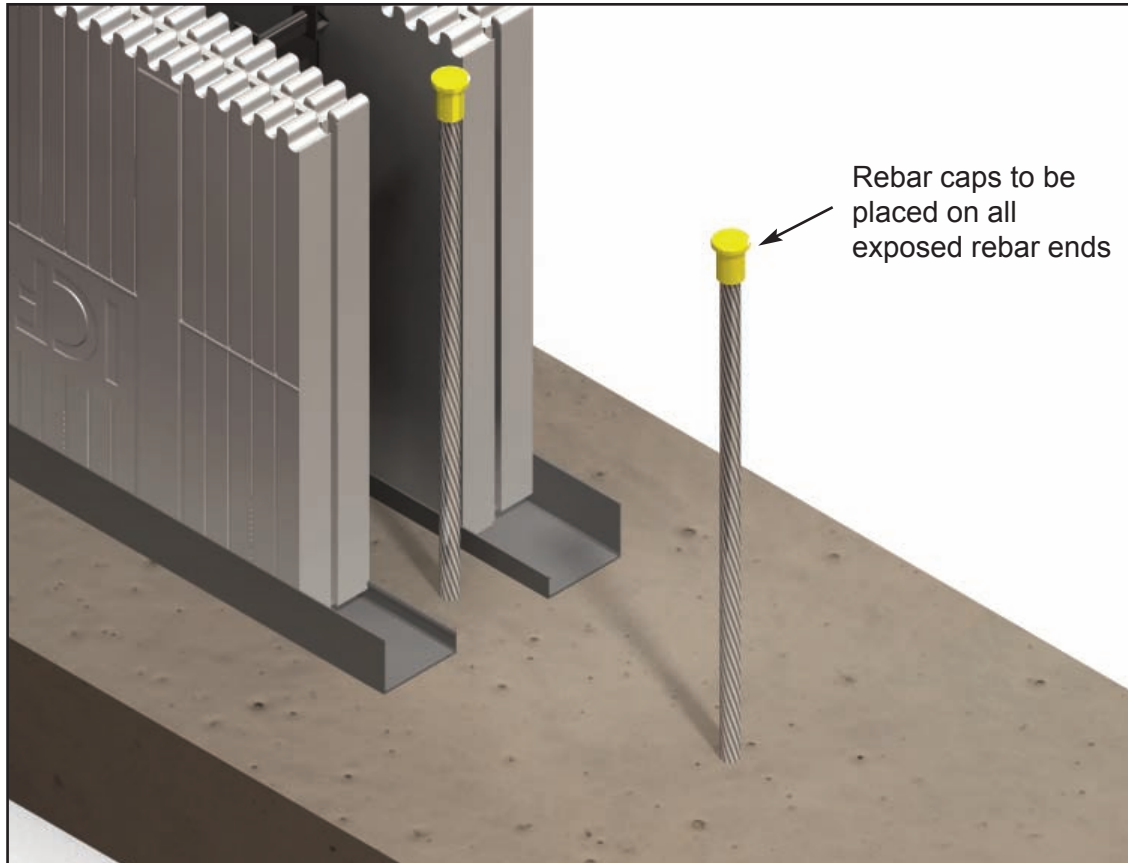


Fig 47 - Detail of starter bar reinforcement



It is not always a requirement to incorporate starter bar reinforcement. This will be determined by your structural engineer.



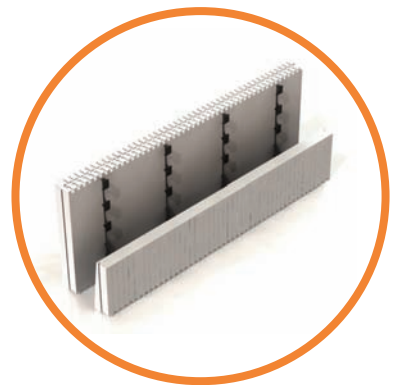
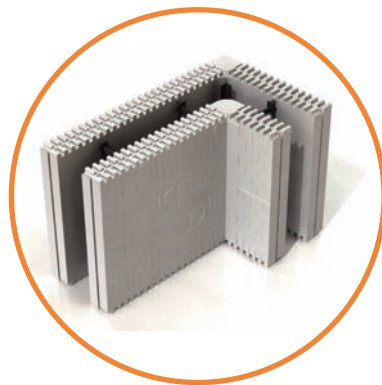
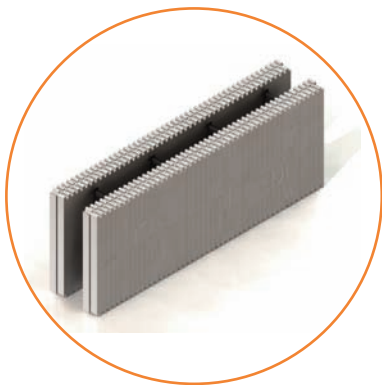
Protruding rebar must be protected by using rebar caps

4.4 COLD JOINTS

As previously stated in the Splice Joint section, it is often necessary to provide a joint to connect vertical rebar from one storey height to another. It is sometimes also necessary to provide protruding reinforcement when a cold joint arises.

This is typical between storey height pours when one storey has been poured and the concrete has initially cured and the second storey has proceeded to a point where it too needs to be poured.

Cold joints are not always necessary, and it is therefore to check with your engineer to make sure that this has not been accidentally omitted.



5

Floors

5 Floors

The connection of timber floors to ICF Tech HouseForms and FloorForms has been detailed in section 4. However, the FloorForm can also be used to support intermediate concrete and composite floors, much in the way that it supports the ground floor and as such, we have provided a set of drawings that detail the use of the FloorForm, both for differing floor constructions, but also in intermediate floor construction.

5.1 PRE-CAST BEAM AND BLOCK - 1

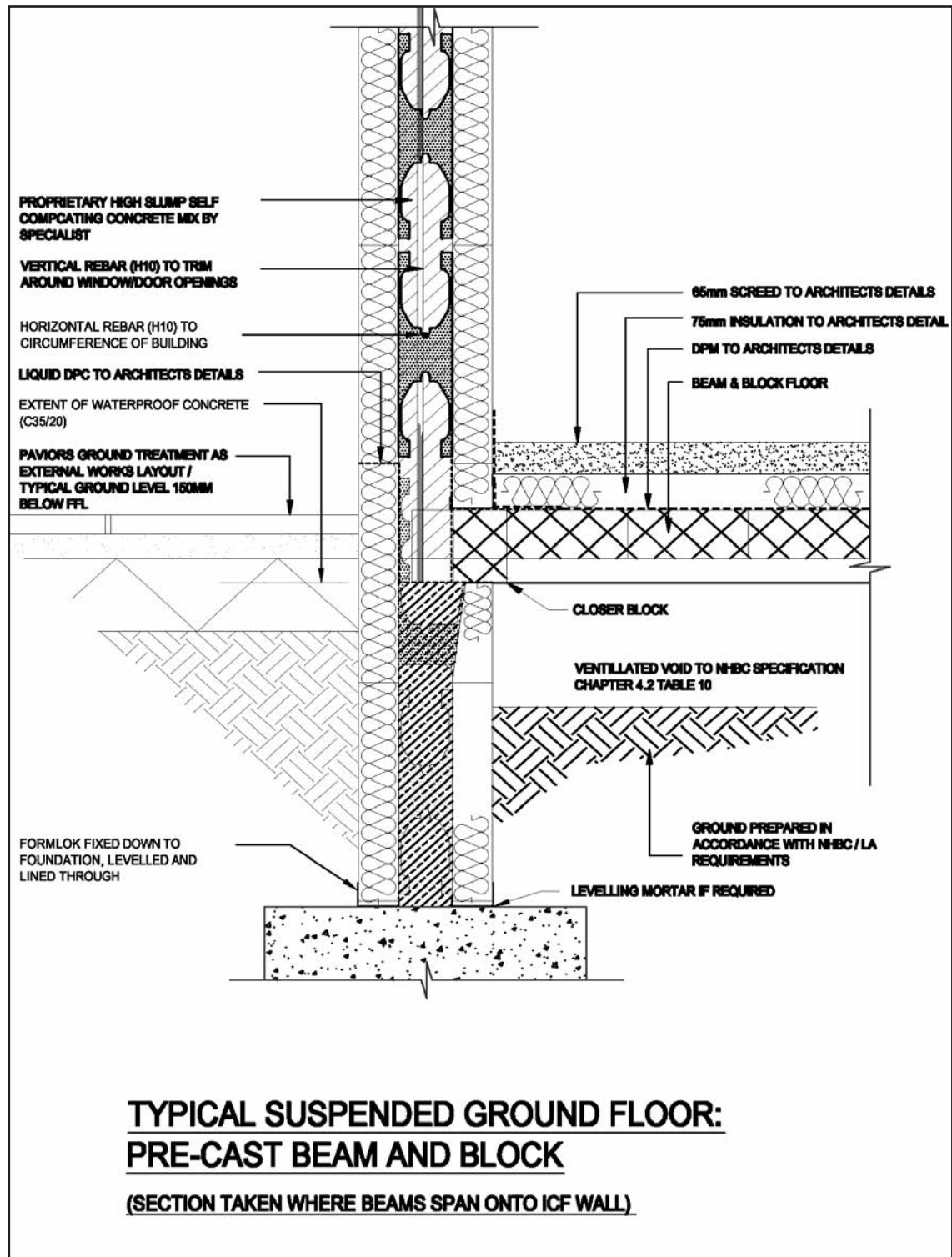


Fig 48 Precast beam and block floor – section taken where beams span on to ICF wall

5.2 PRE-CAST BEAM AND BLOCK - 2

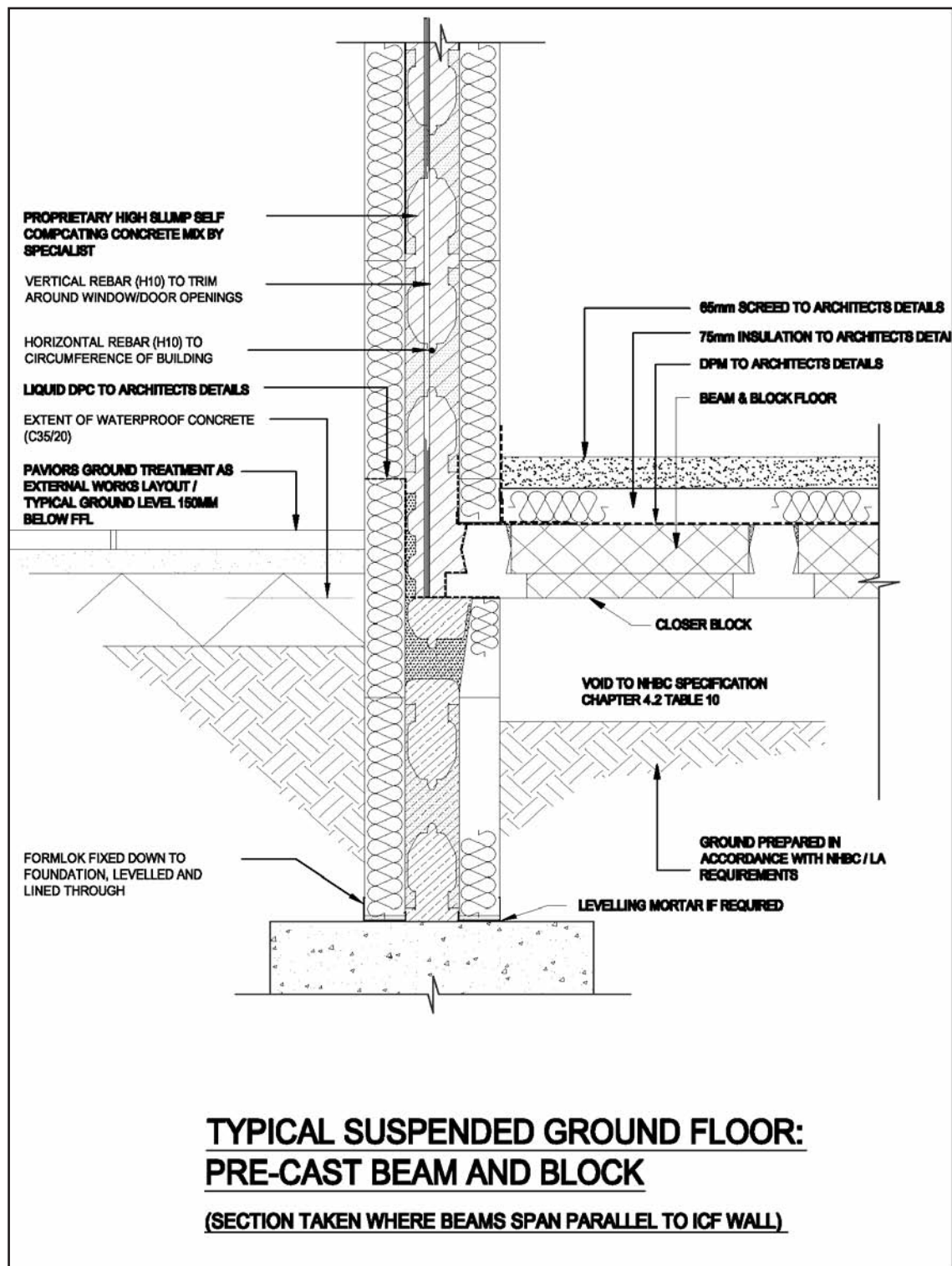


Fig 49 Precast beam and block floor – section taken where beams span parallel to ICF wall

5.3 GROUND BEARING SLAB - 1

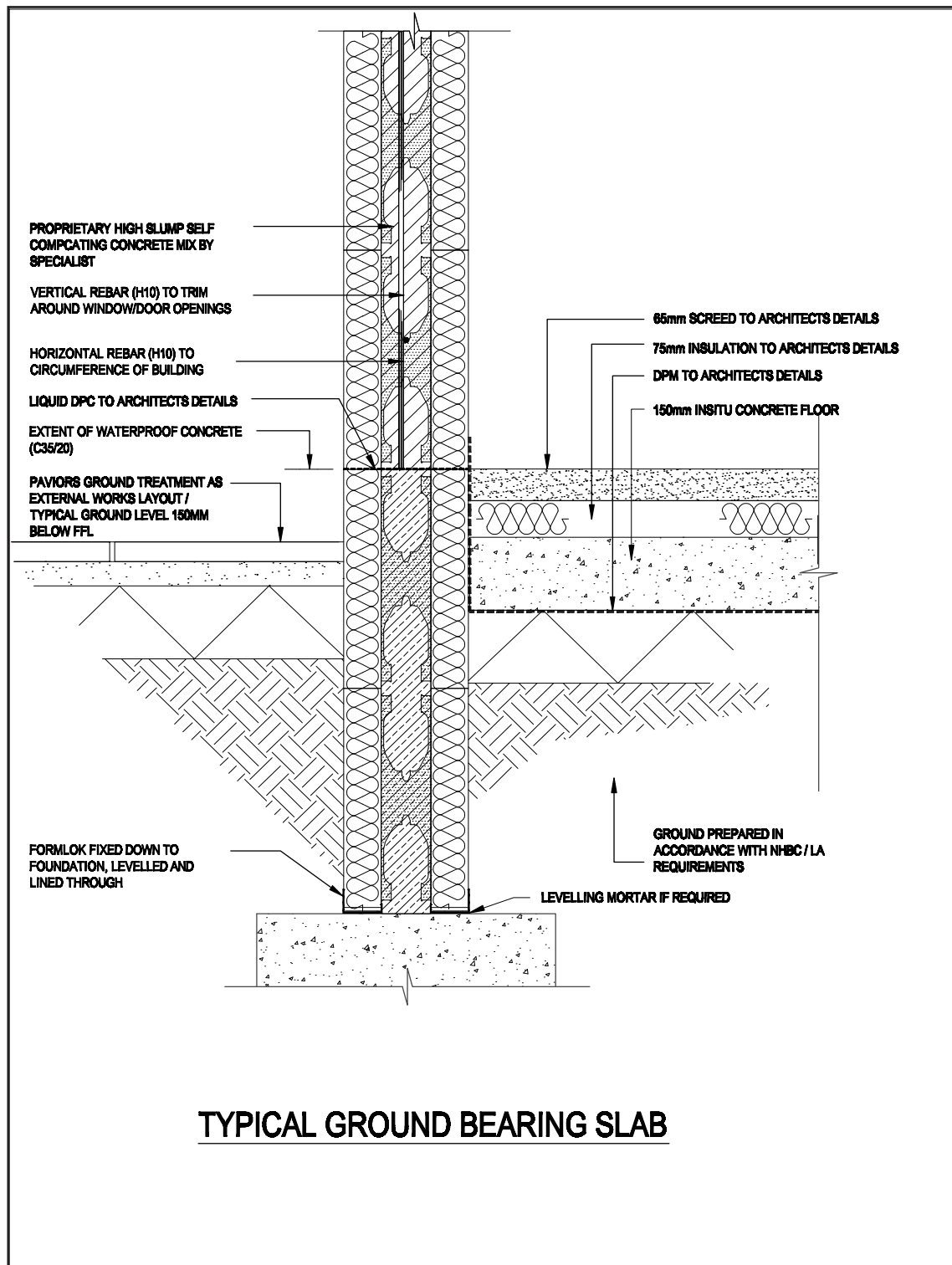


Fig 50 Typical Ground Bearing Slab

5.4 GROUND BEARING SLAB - 2

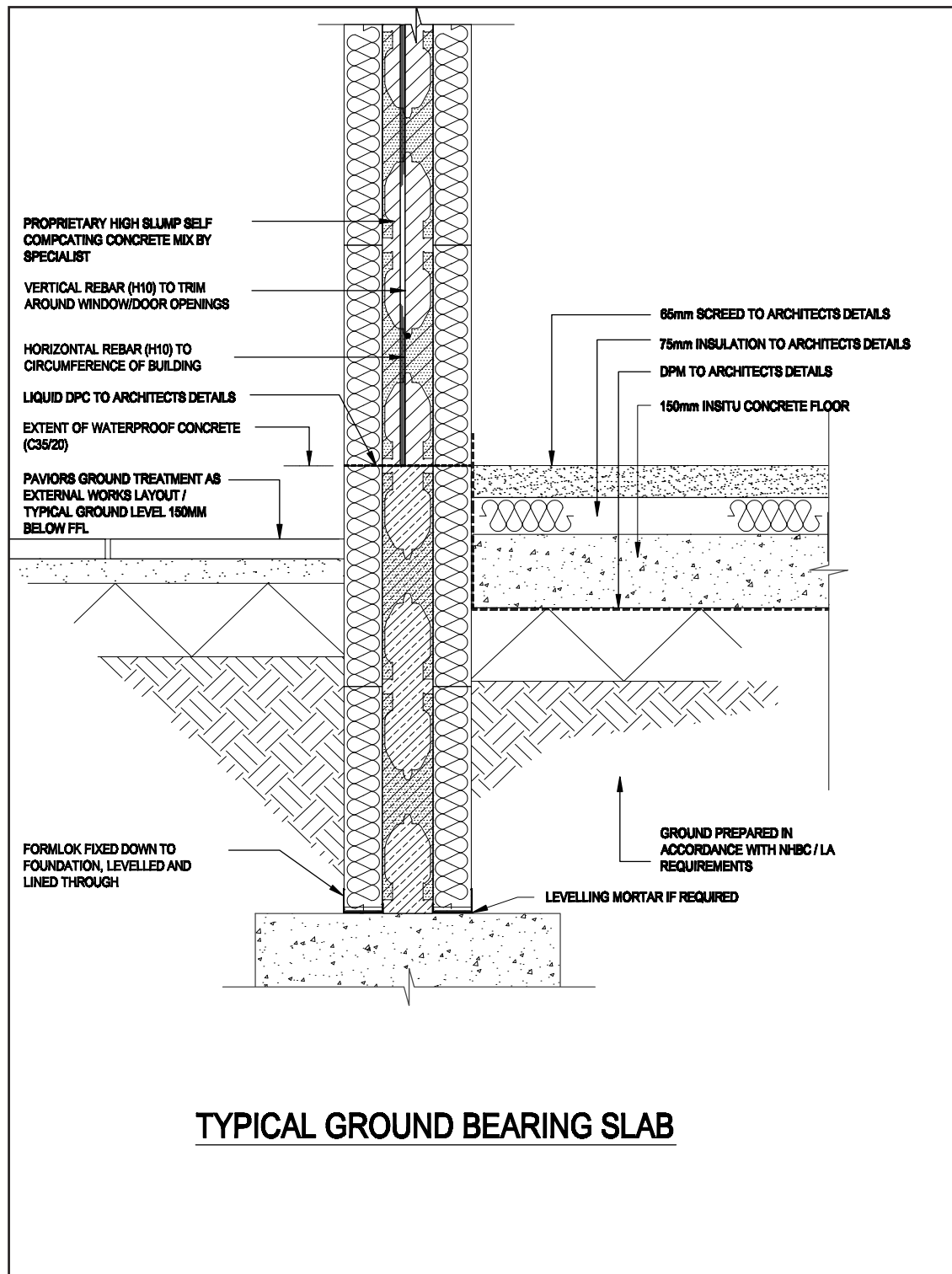


Fig 51 Typical ground bearing slab with level threshold

5.5 PRE-CAST CONCRETE PLANK - 1

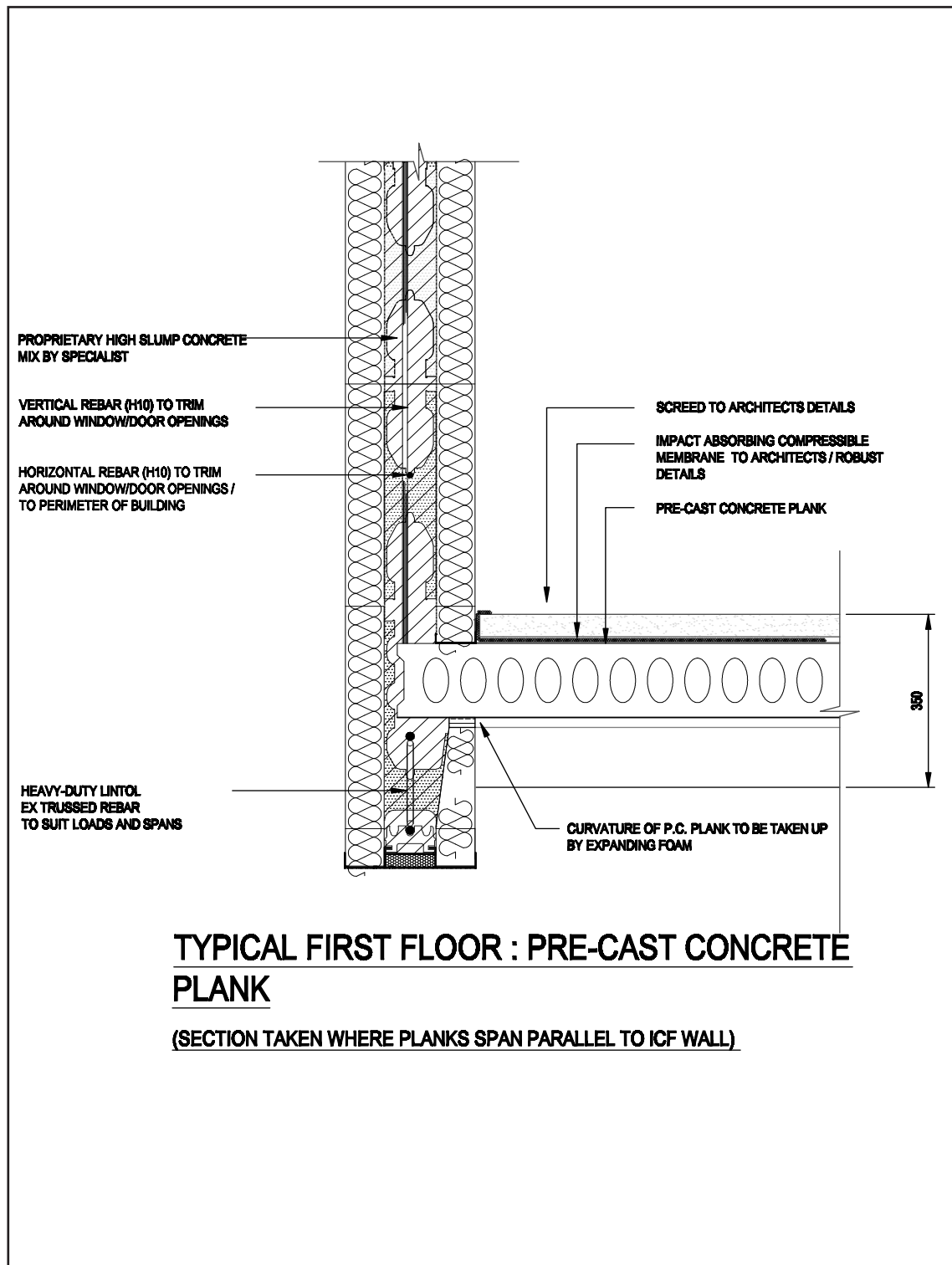


Fig 52 Precast concrete plank – section taken where planks span parallel to ICF wall

5.6 PRE-CAST CONCRETE PLANK - 2

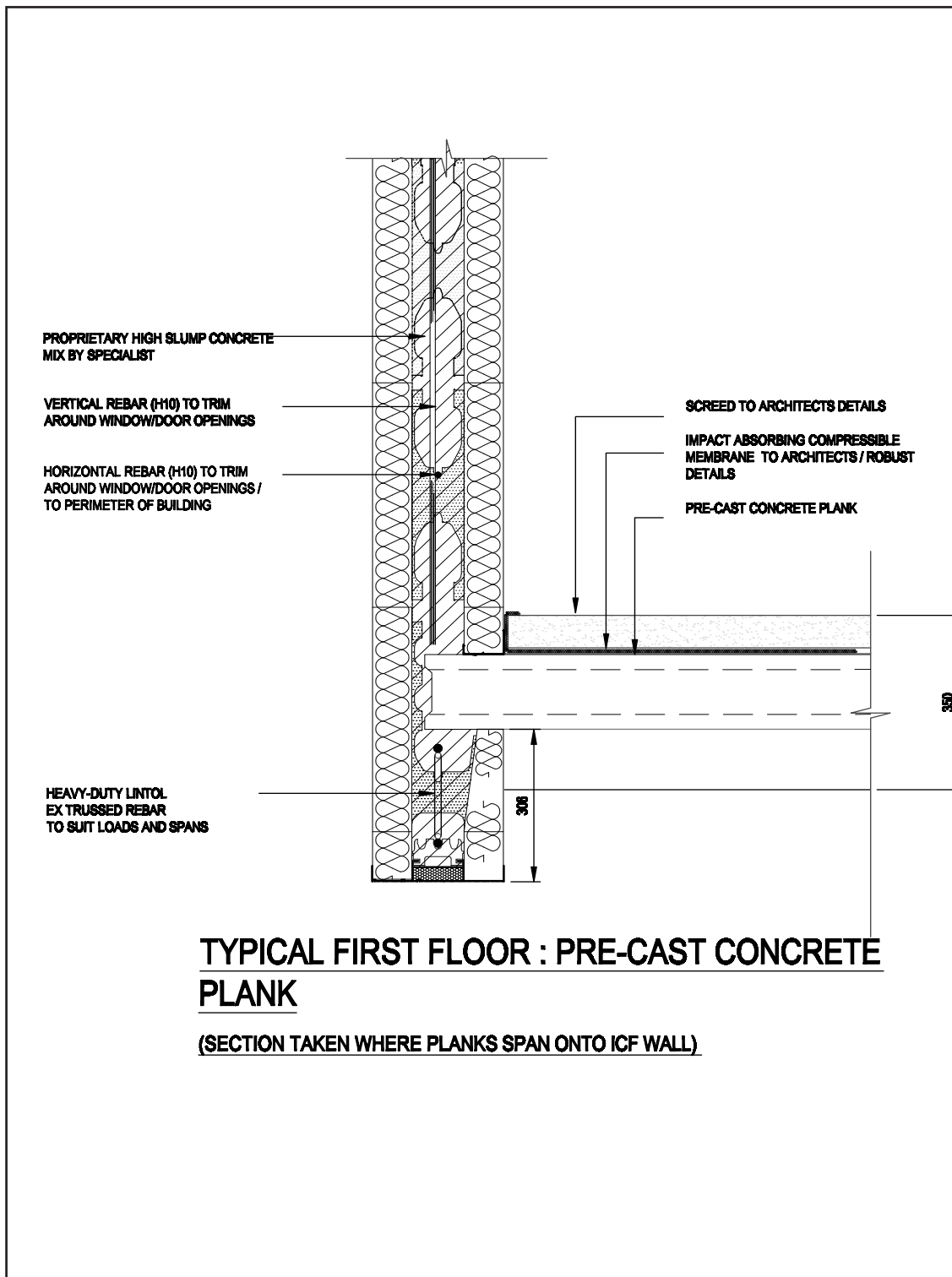


Fig 53 Precast concrete plank – section taken where planks span on to ICF wall

5.7 HANSON JET FLOORS - 1

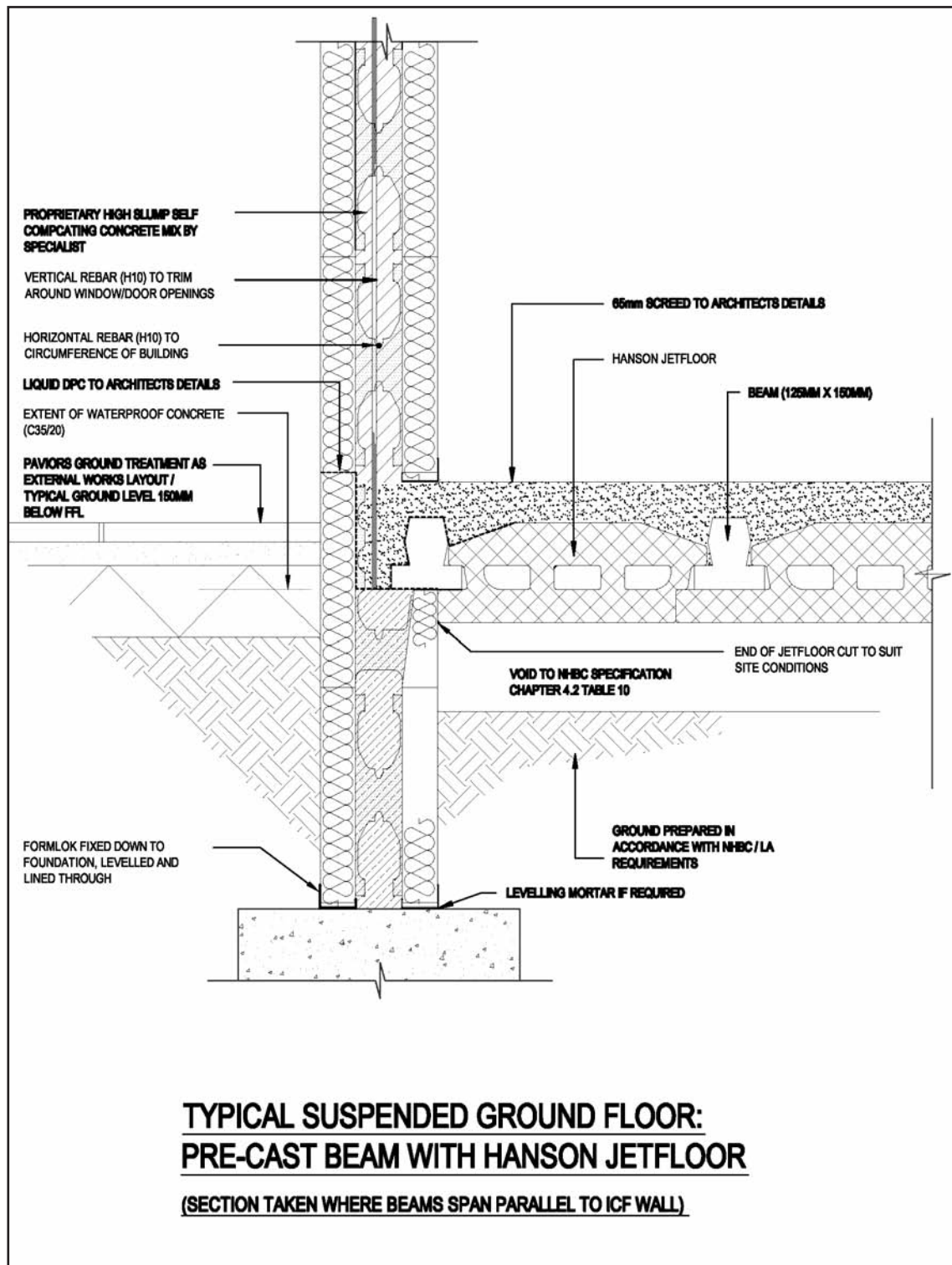


Fig 54 Hanson Jetfloor - section taken where planks spans parallel to ICF wall

5.8 HANSON JET FLOOR - 2

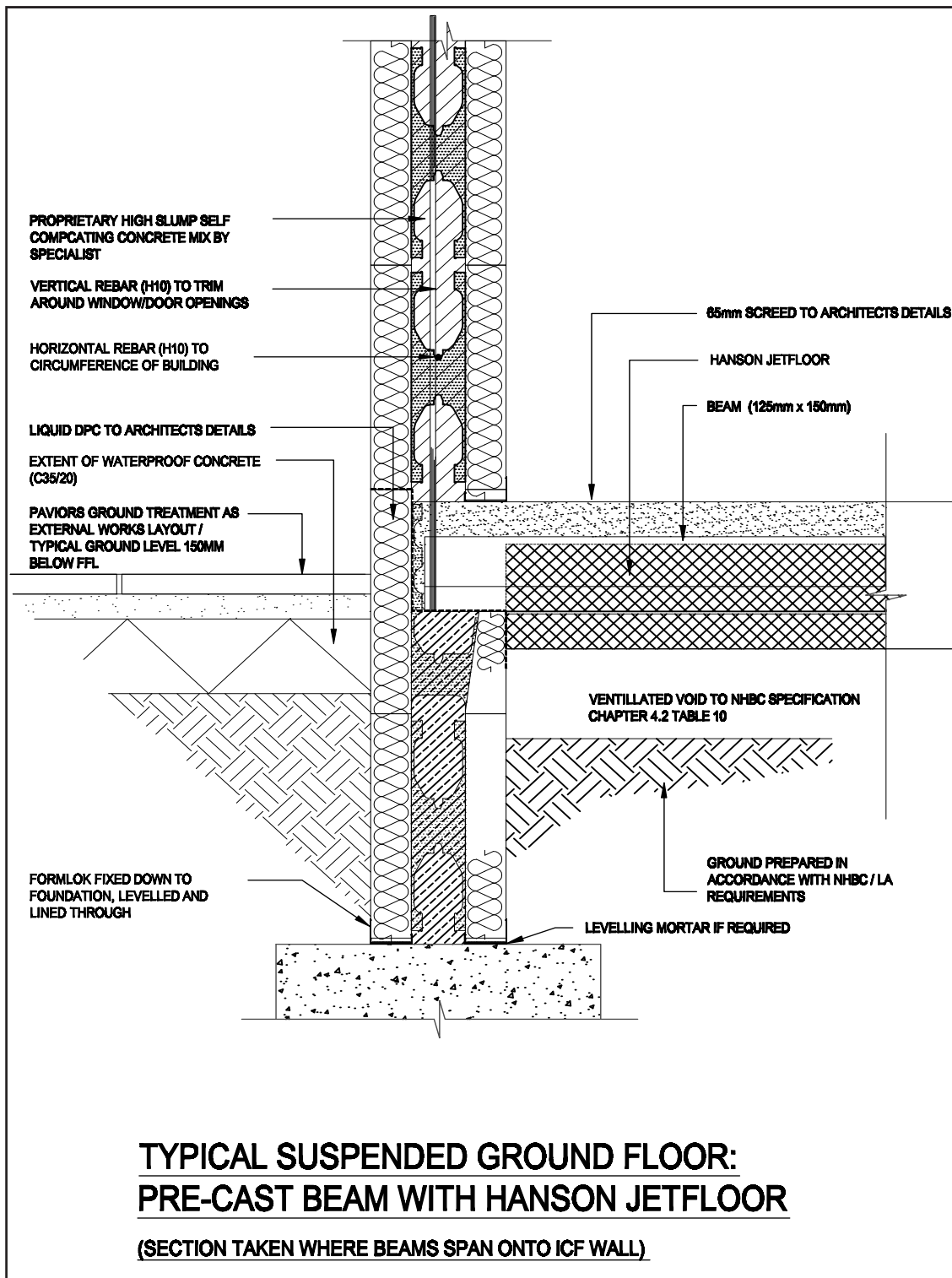


Fig 55 Hanson JetFloor – section taken where beams span on to ICF wall

5.9 TIMBER SUSPENDED GROUND FLOOR

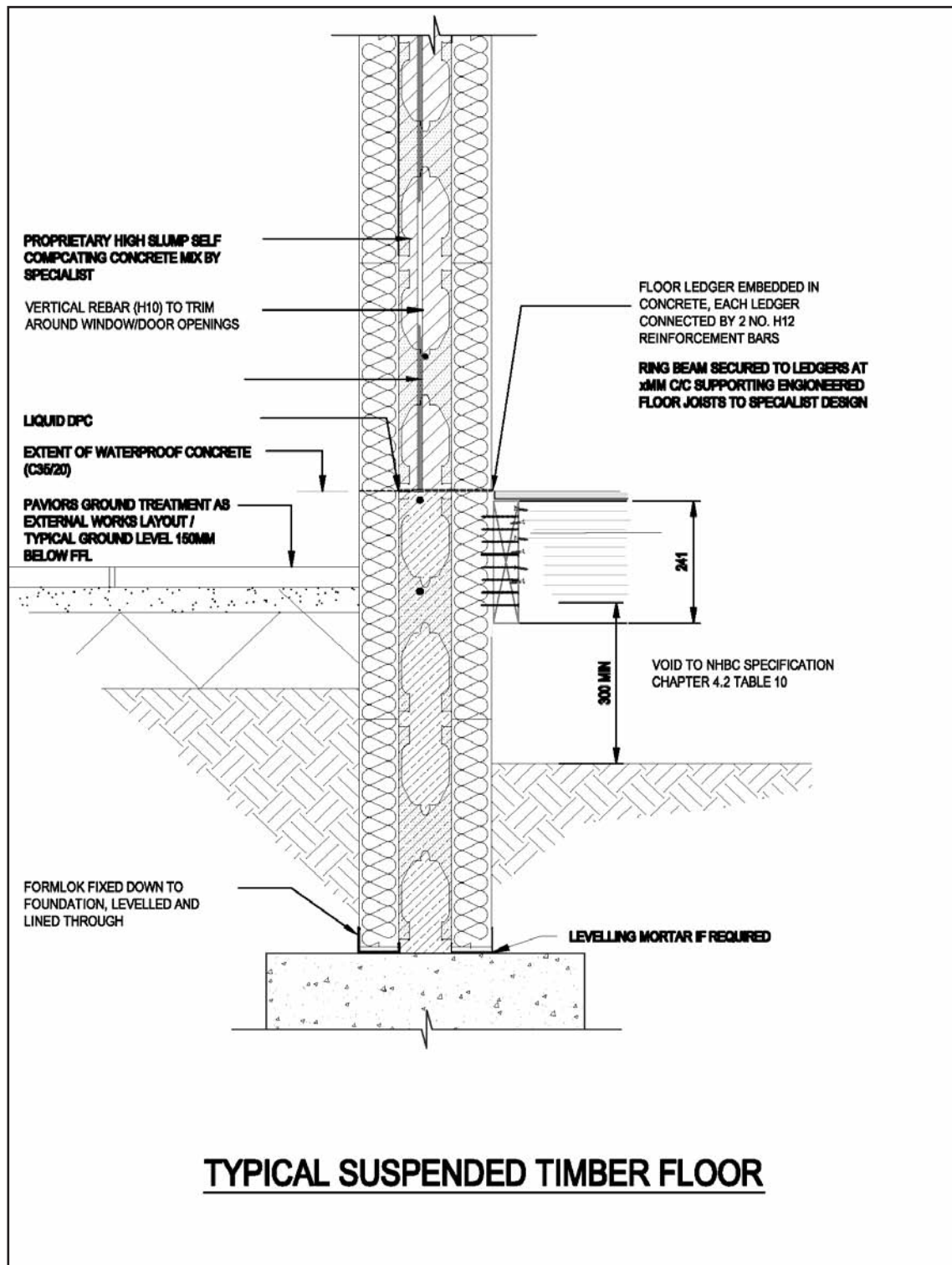
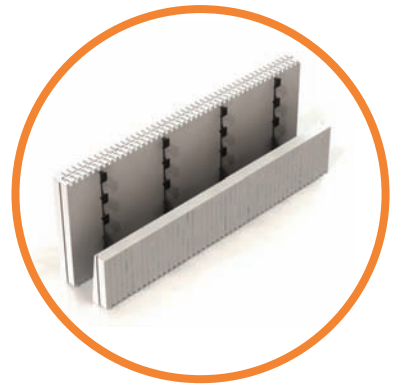
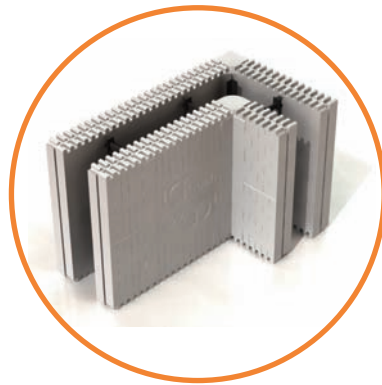
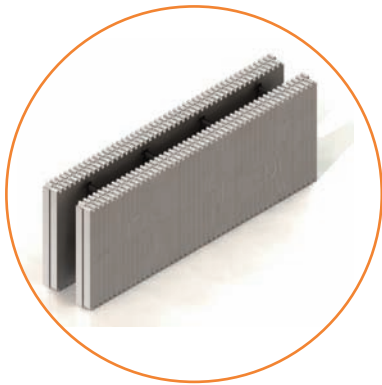


Fig 56 Typical timber suspended ground floor

this page left intentionally blank



6

Construction at roof level

6 Construction at roof level

The details for attaching timber roof members to our High Performance walling system are similar to traditional cavity wall construction, without the need for fixing steel straps to the internal blockwork at 2m centres. The only obvious design difference is that the wall plate is positioned central to the wall.



Ensure your wall height has allowed for the placement at the top of the wall of a course of DIRPS to ensure the wall plate does not foul the tops of the webs.

6.1 WALL PLATE FIXING

We recommend bedding the Wallplate onto the top of the concrete so that the top of the Wallplate remains flush with the top of the form.

The Wallplate will typically be 50mm x 100mm, SC3 grade and treated. In place of the galvanised straps used in cavity wall construction, we recommend M10 threaded bar (or bolt) 200mm long. Rag bolts with a 'U' bend can also be used.

These should be loosely fixed through the Wallplate at maximum 2m centres using an M10 nut and washer, the whole placed into the Form, with the bent part of the threaded bar being inserted into the wet concrete, once the internal web tangs have been removed and excess web material removed to a depth of 50mm, by the use of the bench cutter or reciprocating saw.

Once the concrete has cured, the Wallplate nuts can be tightened.

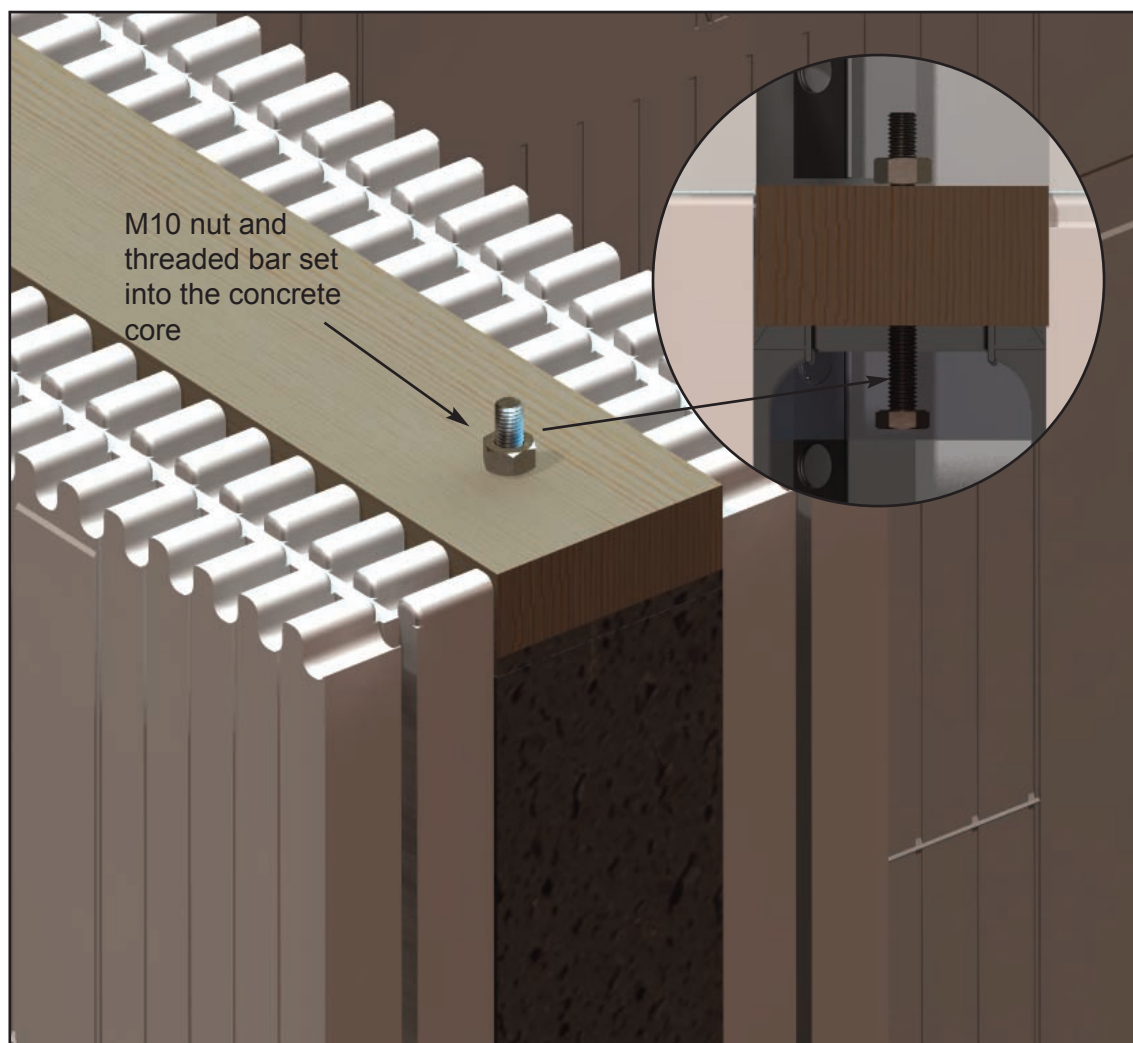


Fig 57 Detail of wall plate and FormLok at roof level

6.2 RAFTER FEET CONNECTION

6.21 Trussed rafters

Trussed rafters should be fixed to the Wallplate with proprietary fixings, such as the Strong-Tie Type A23 Angle bracket, fixed with 8No. 3.75x32mm wire nails. The diagram below show a simple angle bracket used. As with cut roofs, trussed rafters can be easily accommodated by cutting a small piece of EPS from the outside skin of the ICF Form.

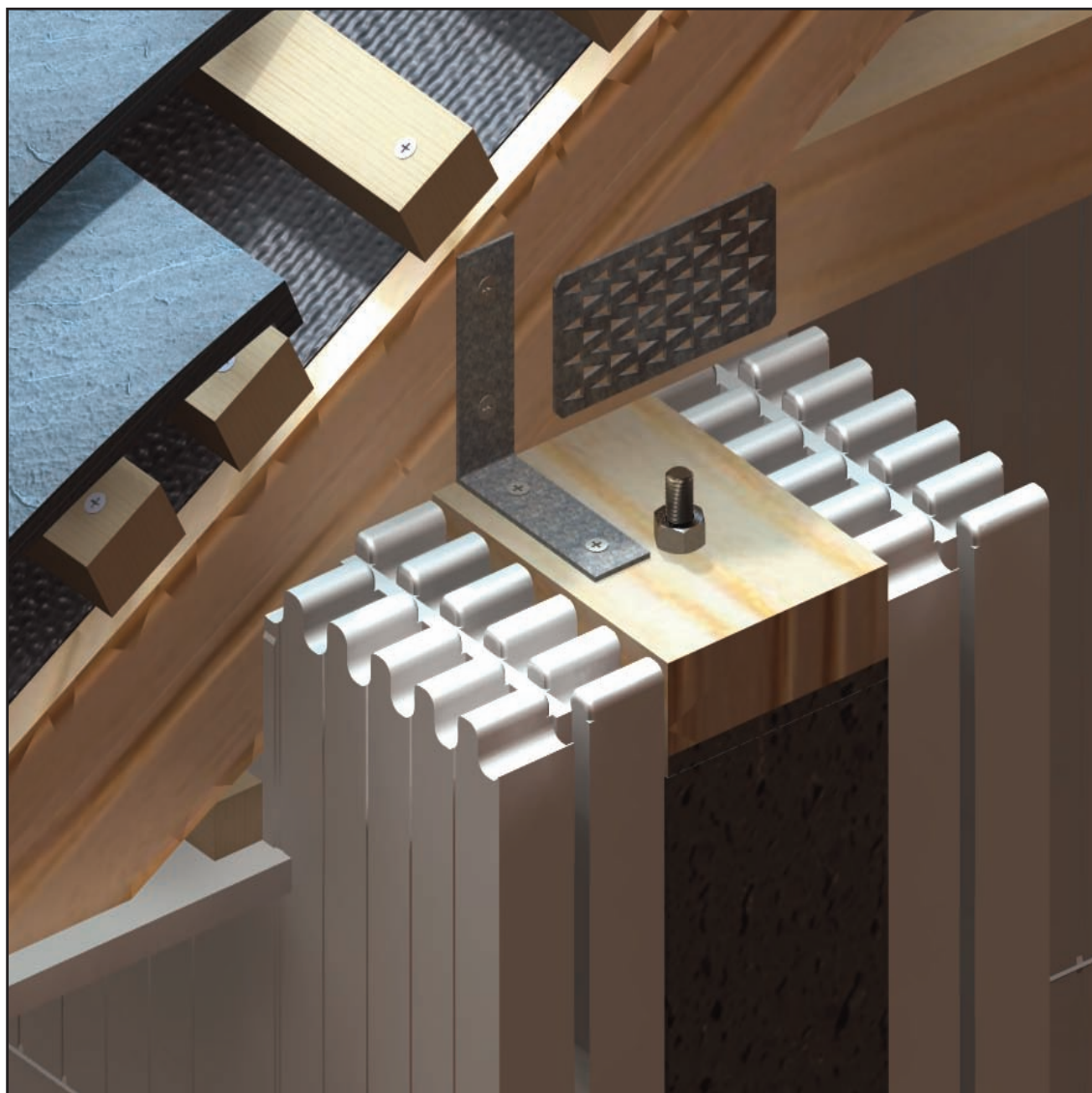


Fig 58 Detail of Roof Truss and Wall Plate

6.22 Cut roofs

Cut roofs traditionally require the rafter feet to be birdsmouth jointed to the Wallplate with the outer skin of the cavity wall being built-up to suit the proposed eaves level, being lower than the Wallplate formation level.

This detail is easy to replicate without loss of insulation integrity as all that is required is to cut an angled slot into the external face of the EPS to accommodate the end of the rafter.



Care should be taken to ensure that the forms making the gable end are securely tied together with any cut forms used for the apex glued in place to provide additional strength prior to cutting.



Ensure that a suitable external and internal scaffold is erected prior to forming the gable wall.

6.3 GABLE WALL CONSTRUCTION

Gables present no special difficulties with our high performance walling system, as all pitches can be accommodated.

6.31 Form placement

We recommend forming the gable wall once the trusses are in place, which is a similar practice to cavity wall construction.

This will allow easy setting-out of the correct pitch and also allow for the provision of gable ladders and the extension of purlins etc. should the design require this. This method also allows the end truss to act as the Form bracing, as our Easirect Bracing and Alignment System cannot be used in this location, due to the truss members position, especially when the gable forms a party wall between buildings.

An independent scaffold deck should be provided at ceiling level, with additional platforms required as necessary to reach the apex of the gable.

Forms should be built-up in courses, as per our normal wall construction process, but allowing for the cut-line of the roof pitch, resulting in a castellated triangle as shown below.

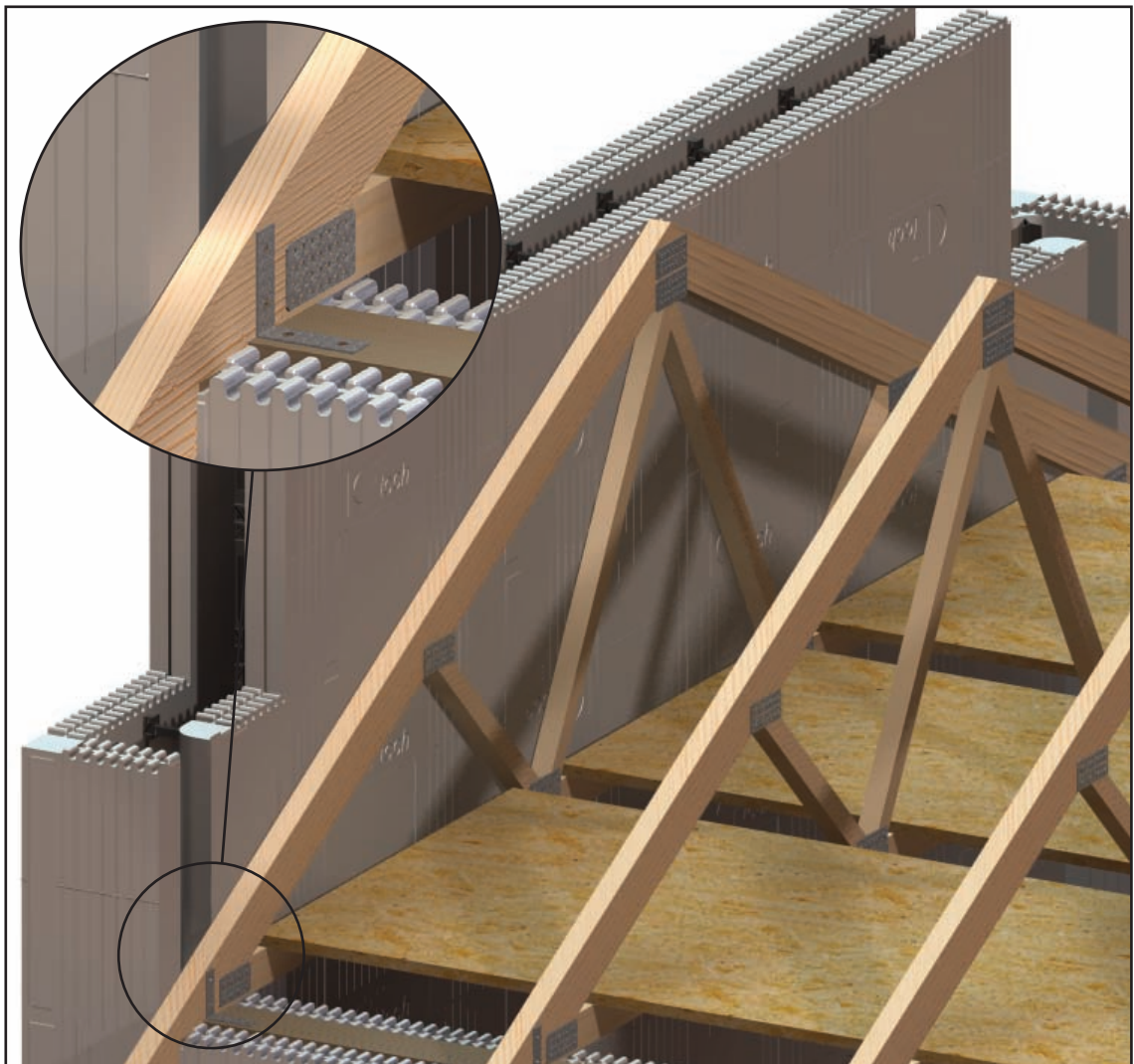


Fig 59 - Forms built-up next to roof truss prior to cutting

6.32 Bracing and cutting to pitch

Once the roof trusses/cut roof timbers have been installed and braced and the Forms built-up as previously described, the gable wall needs to be braced before cutting to the line of pitch takes place.

Depending on the format of the Trusses (Fink Fan, Warren etc.) locate the line of web firings and screw through the truss members. Additional bracing support maybe required to the central part of the gable, particularly when a cut roof is detailed and in such situations, temporary timber and ply bracing should be used, as shown below.

Once the wall has been braced, the pitch line can be cut through the Forms, using a reciprocating saw, with remaining webs being cut back beneath the rake line by 40mm to ensure the correct insertion depth for the FormCloser.

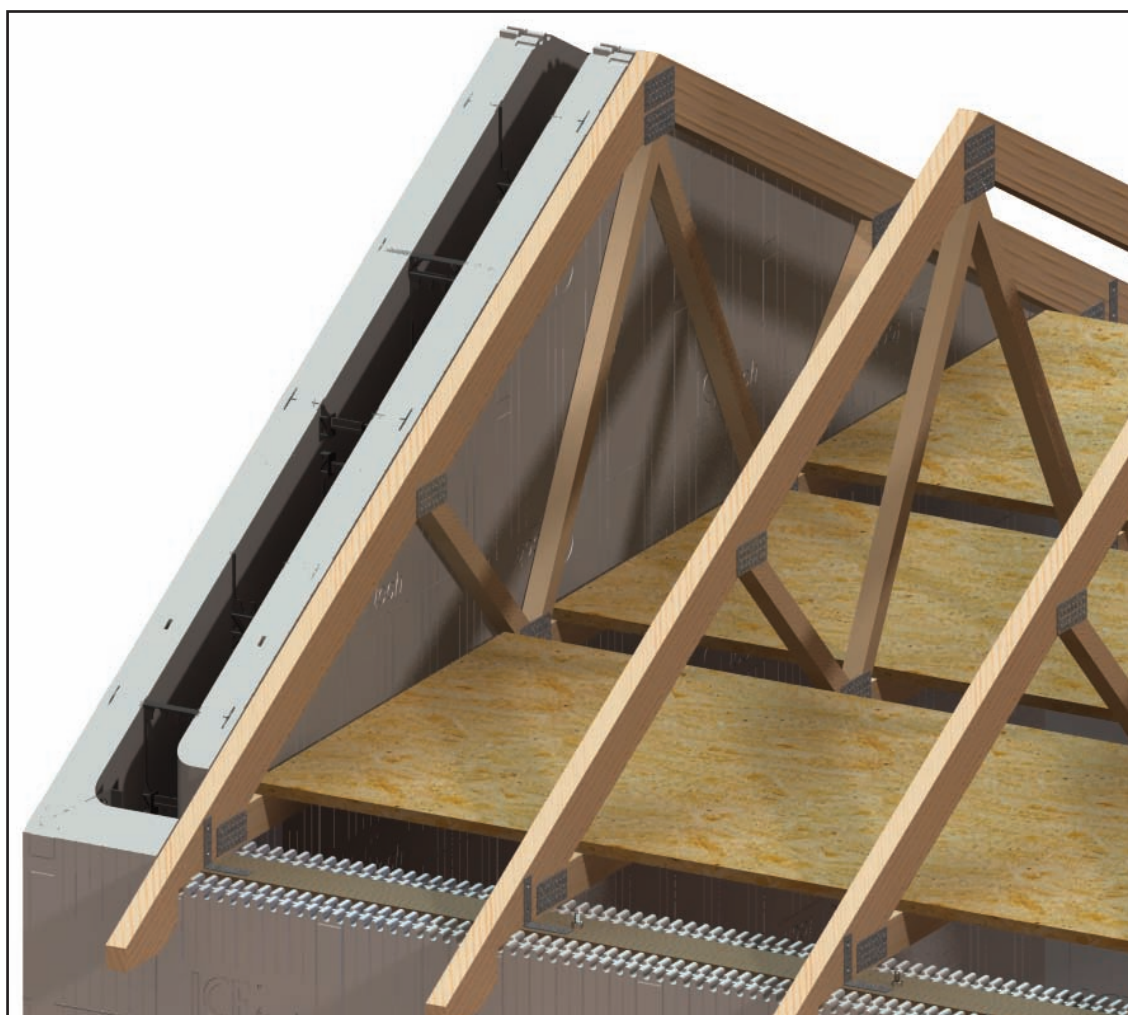


Fig 60 - Gable end wall showing cut forms ready for concrete pour

6.33 Gable ladders

Once the gable line has been cut and any webs reduced below the cut face of the EPS skins, it is time to cut-out slots in the ICF wall face to accommodate the Gable ladders. The timbers forming the ladder can then be fixed to the end rafter by screw-fixing through the end rafter into the noggin (Fig 61). Remember to leave a 300mm gap at the top of the Gable to allow access for the concrete delivery hose (Fig 62).



Use fibre tape to securely fix the FormCloser back to EPS and fill any holes left by cutting-in the gable ladders with expanding foam.

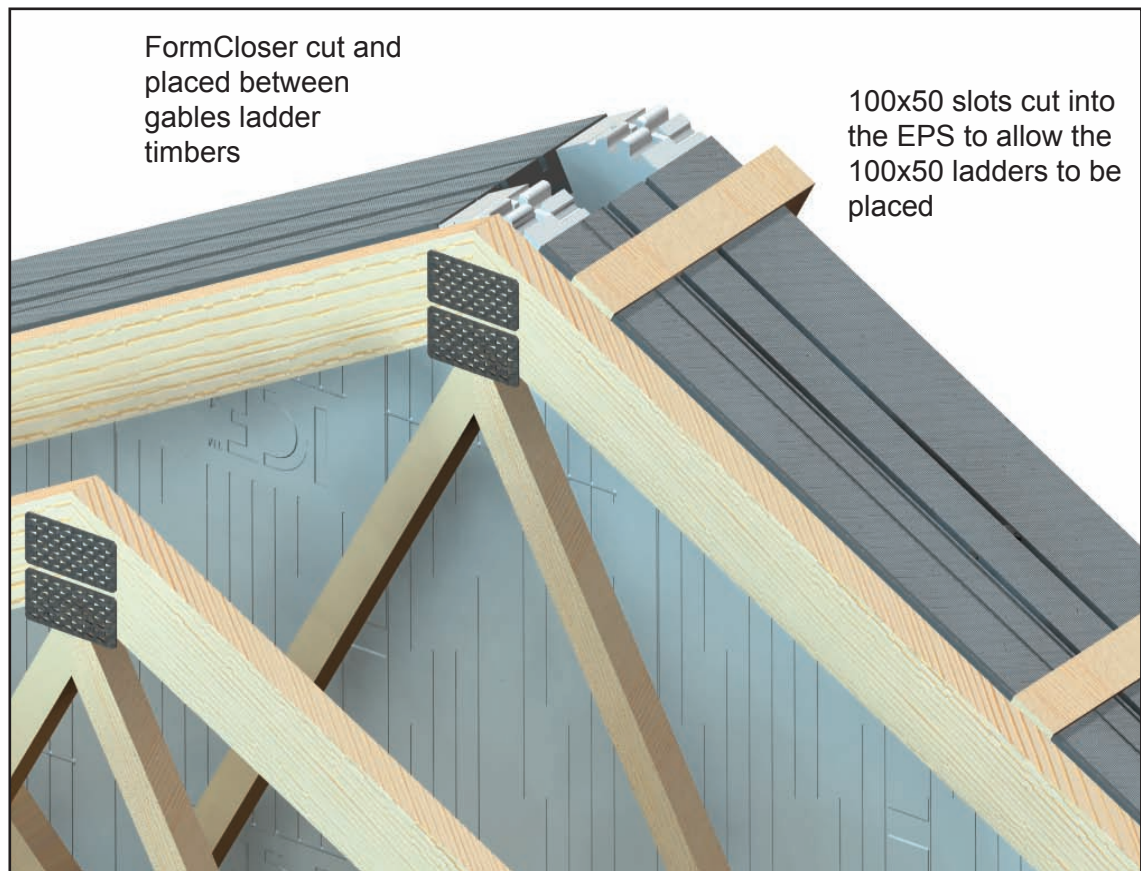


Fig 61 - Detail of Gable Ladders

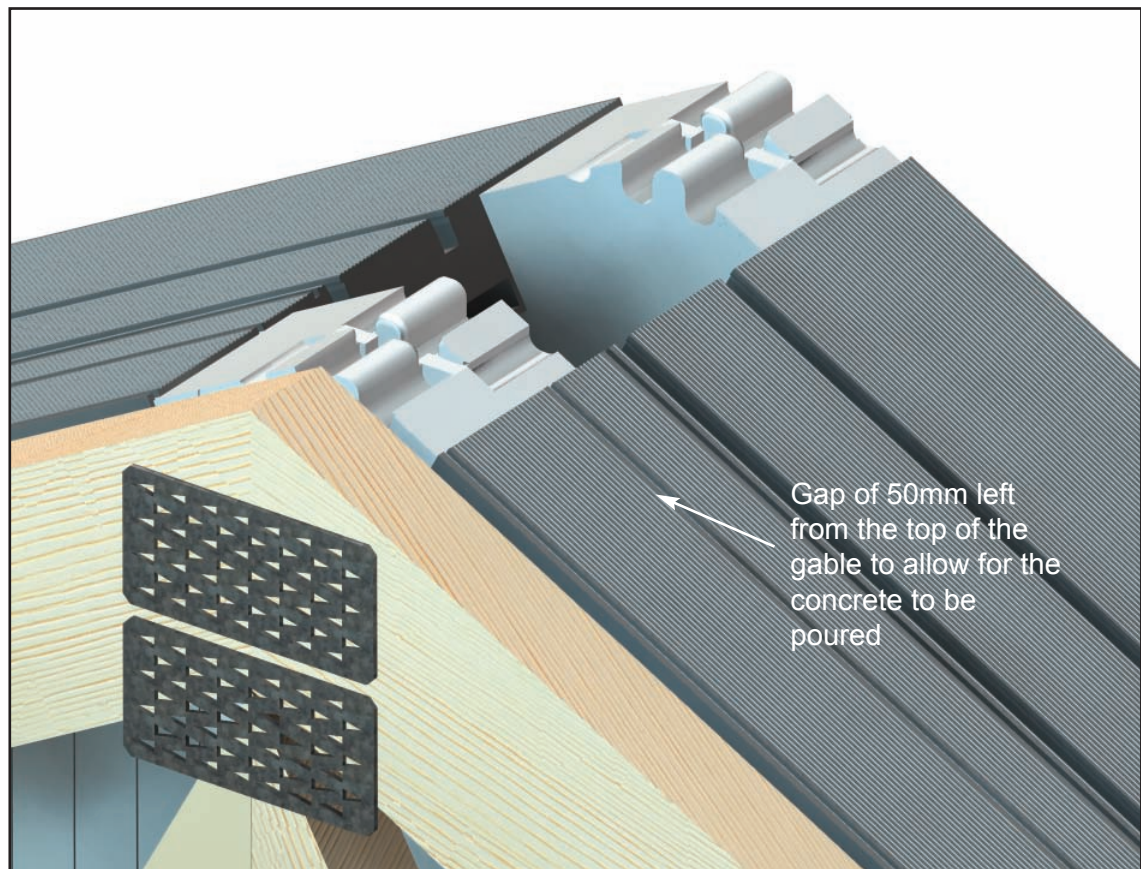
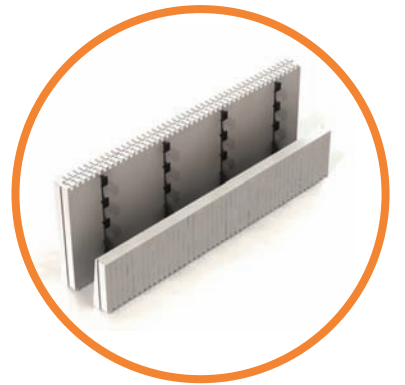
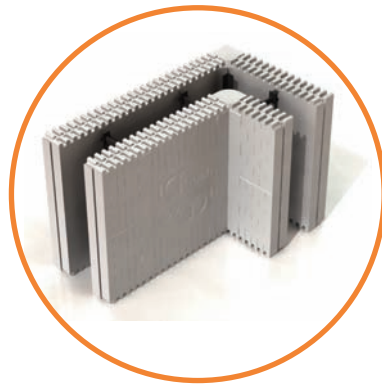
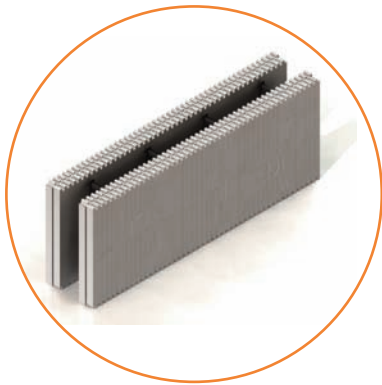


Fig 62 - Detail of gap in FormCloser at top of Gable Wall

6.4 CORBELS

If the design indicates the insertion of brick or stone corbels, these can be accommodated by stripping away the EPS face where the corbel is to be located, and attached a Halfen (or similar approved) stainless steel brick ledge, and then the brickwork can be built-up course by course, each course being tied-back to the concrete core with suitable stainless steel ties.

If a stone corbel is to be used, allowance for this should be made prior to completing the final storey pour, as a block of EPS representing the built-in depth of the corbel should be glued to the rear face of the Form which will then leave a void once the concrete has been poured, which is then used as the ledge where the corbel is to be fitted.



7

Other construction

7 *Other construction*

7.1 BASEMENT CONSTRUCTION

Basements can easily be constructed using the ICF Tech WallForm and the same principles can be adopted when forming swimming pool enclosures.

The Approved Document “Basements for Dwellings” was revised in 2007 to include new design details for plain concrete walls, with section 3B containing tabular information for the design of reinforced basement walls.

The Concrete Centre has also recently issued their “Design and Construction using

Insulated Concrete Formwork” guide, which refers to basement construction in chapter 5.7, using a modified table derived from the Approved Document.

We recommend the use of RIW Flexiseal which is a solvent-free thixotropic liquid based on urethane pre-polymers, which on contact with atmospheric moisture, cures to give a continuous tough rubber-like coating.

It is used with Flexiseal Primer and the whole should be protected from backfill by the use of RIW Protection Board. Manufacturers details should be followed regarding application, sealing around service penetrations and ground drainage at the foot of the structure.

7.2 TEE WALL

Tee walls typically occur when party walls are formed and are easy to form using the ICF Tech High Performance Walling System.

The length of wall forming the external wall will need to have a section removed to allow the concrete to flow, and will mimic the width of form, i.e, a 100mm wide slot for the HouseForm and a 150mm wide slot for the WallForm.

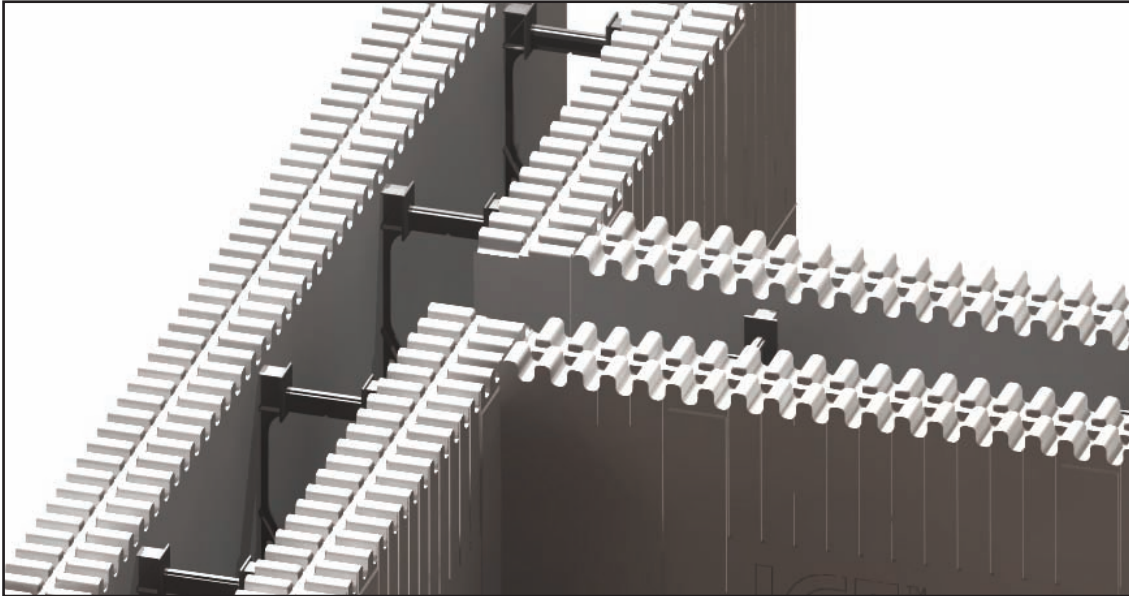


Fig 63 - Preferred arrangement for forming 'T' walls

Always ensure that conversions of house plans are adapted so that the cut in the ICF panel NEVER occurs opposite a web. ALWAYS ensure that the cut is in-between two webs. If it is essential to cut the panel opposite a web, additional external support maybe required during the concrete pour.

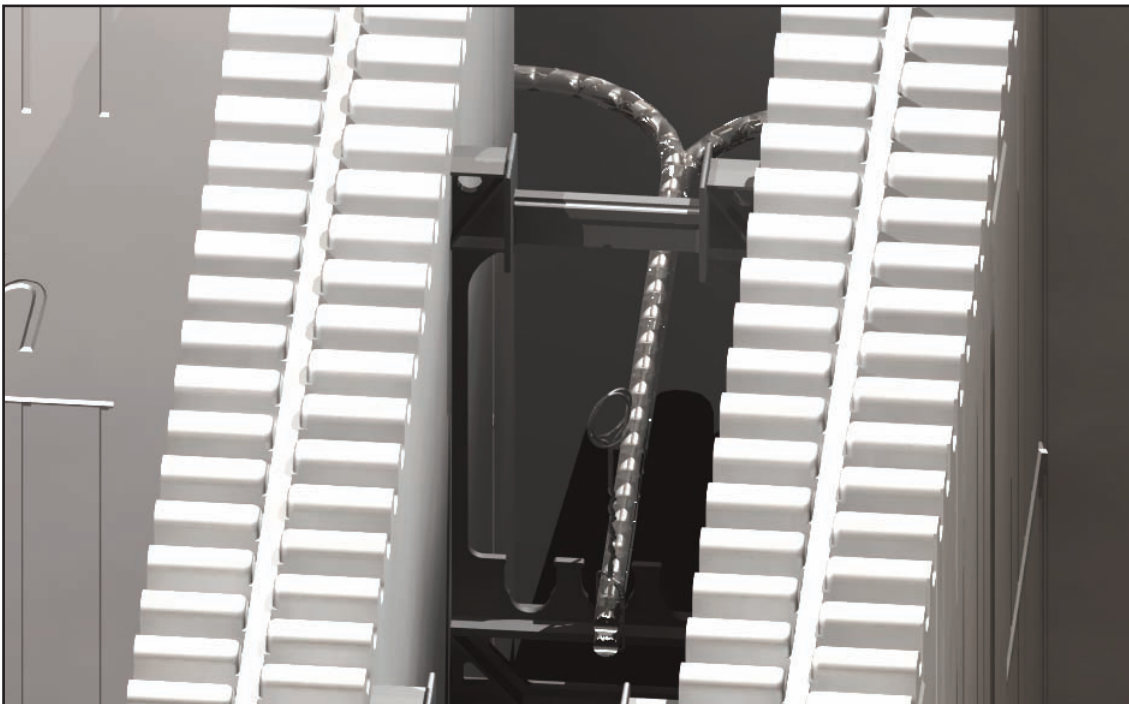
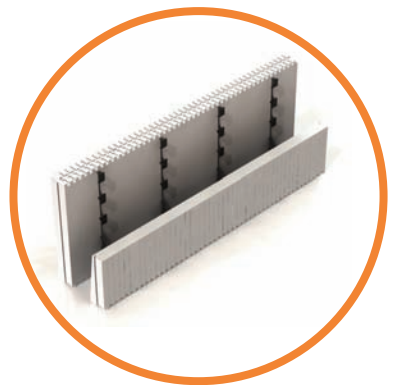
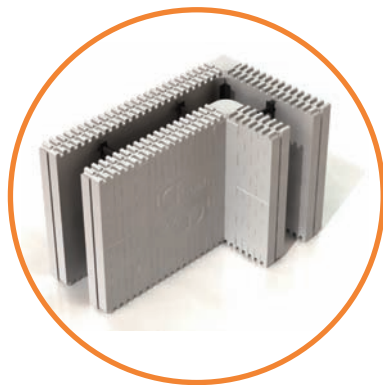
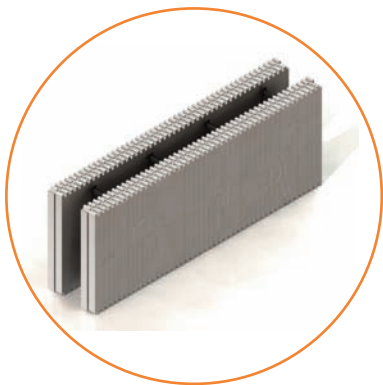


Fig 64 - Rebar and tie-wire detail



8

CAD details

8 CAD details

8.1 RETAINING WALL - BASEMENT

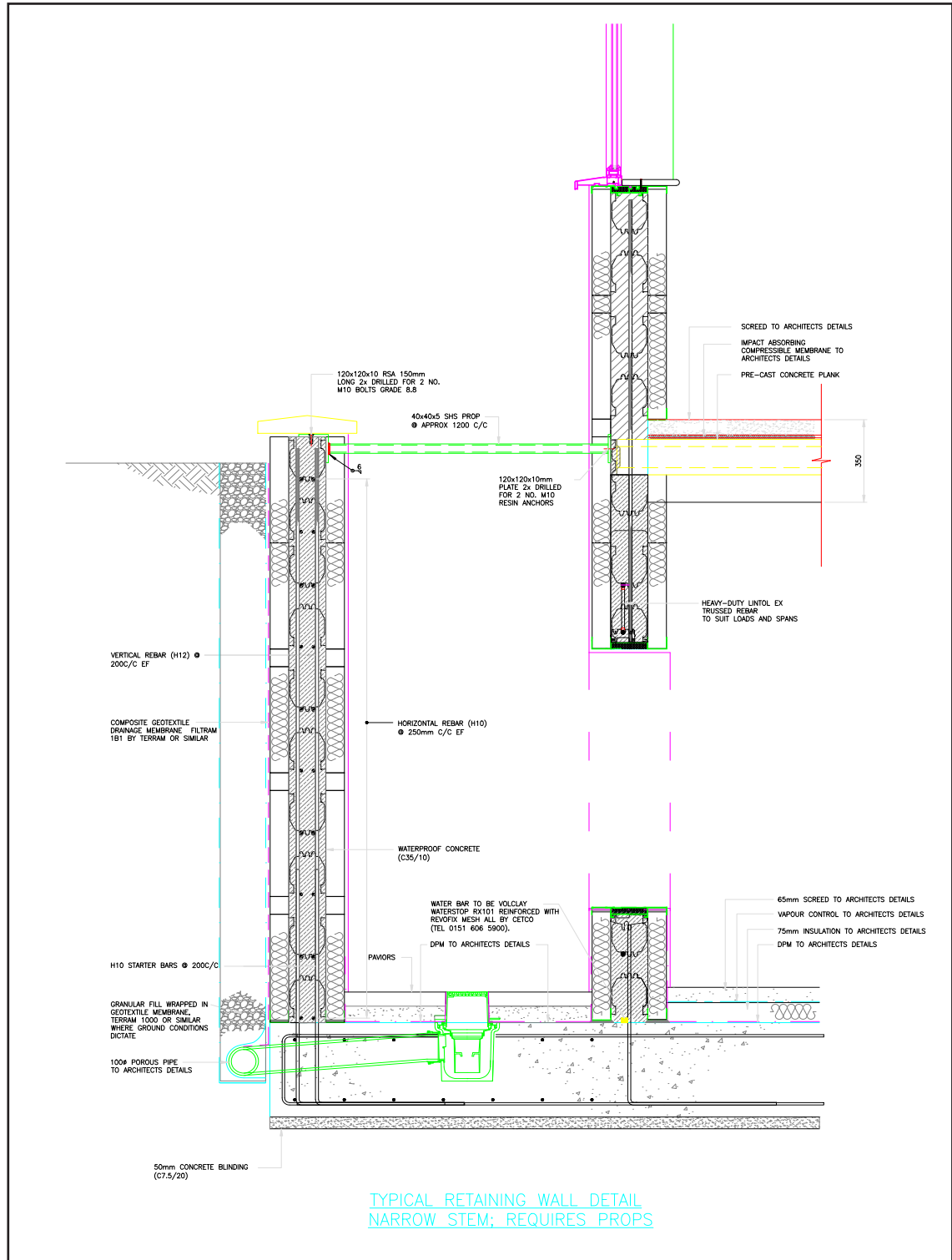
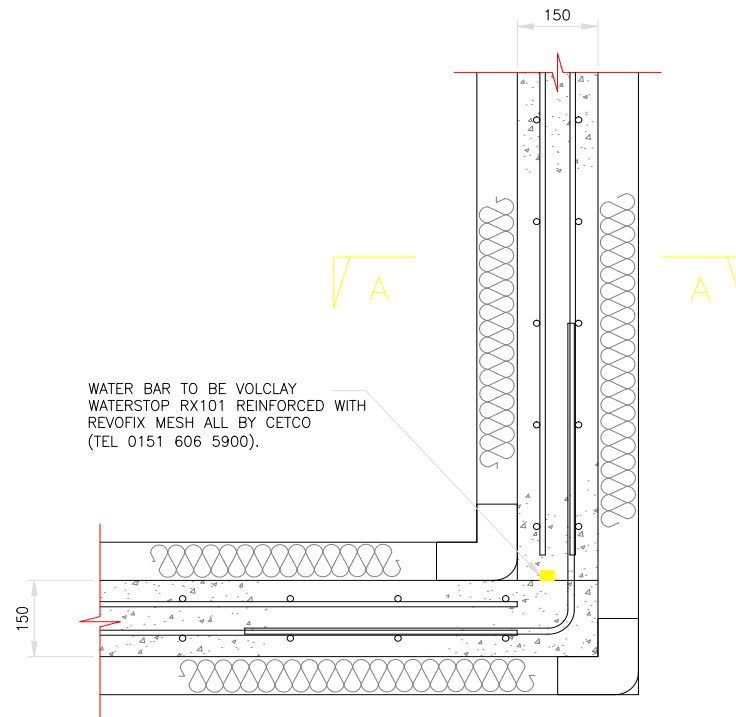
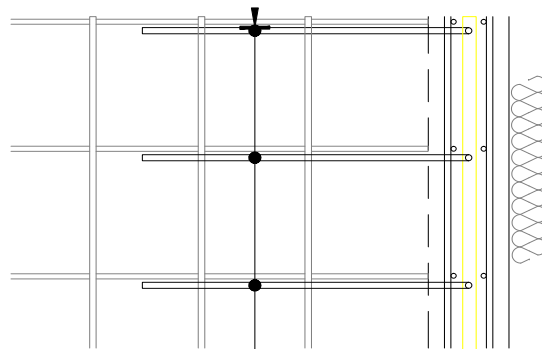


Fig 65 - Retaining wall - basement

8.2 RETAINING WALL - CORNER



PLAN ON CLOSING CORNER OF
RETAINING WALL OR BASEMENT



L-BARS PLACED AT SPACINGS TO LAP WITH
HORIZONTAL BARS OF THE RETAINING WALL

BASEMENT/GROUND FLOOR JUNCTION
TYPICAL ALTERNATIVE REINFORCEMENT

Fig 66 - Retaining wall - corner

8.3 RETAINING WALL - TEE

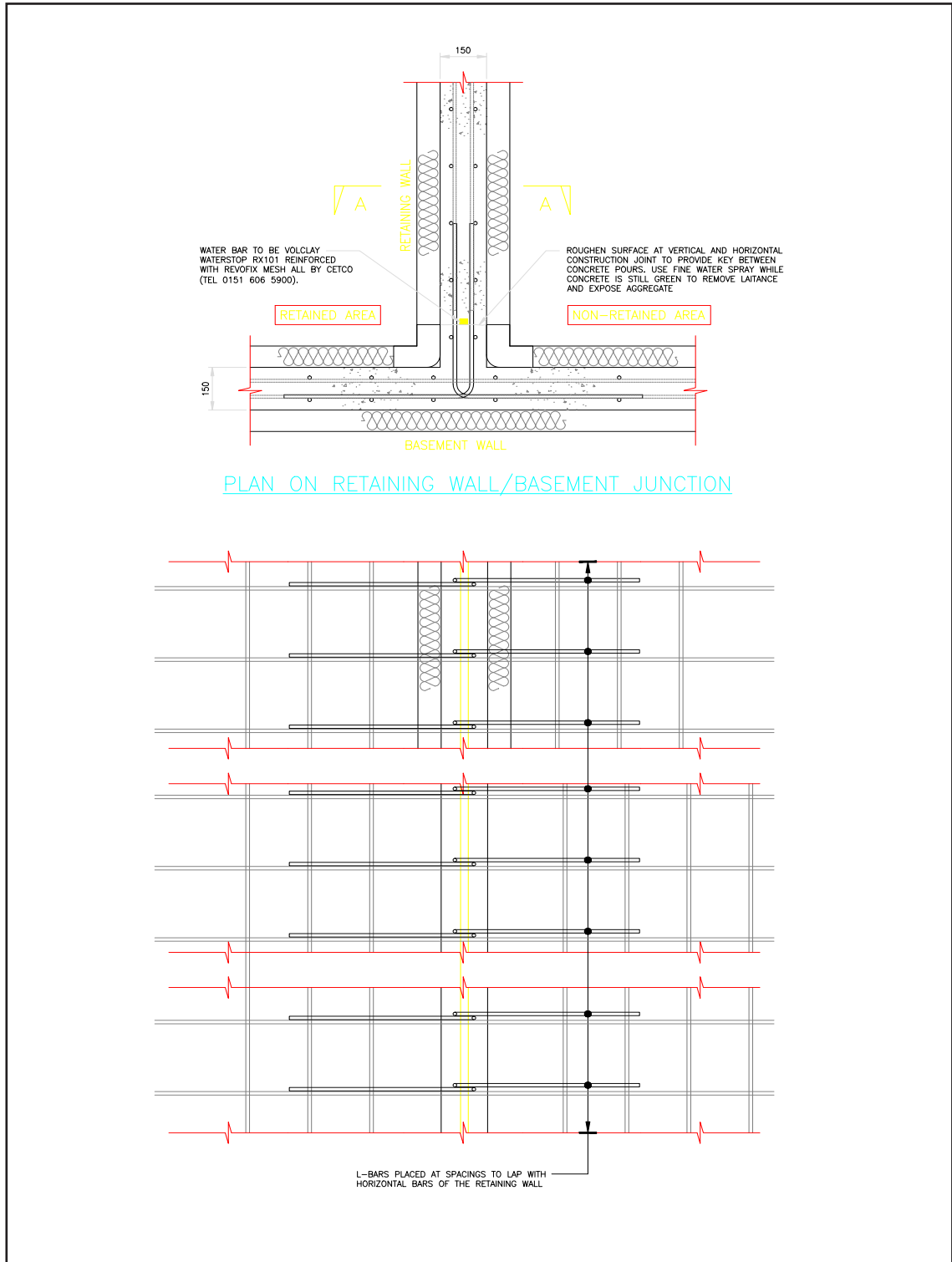


Fig 67 - Retaining wall - tee

8.4 ROOF TRUSS - EAVES LEVEL

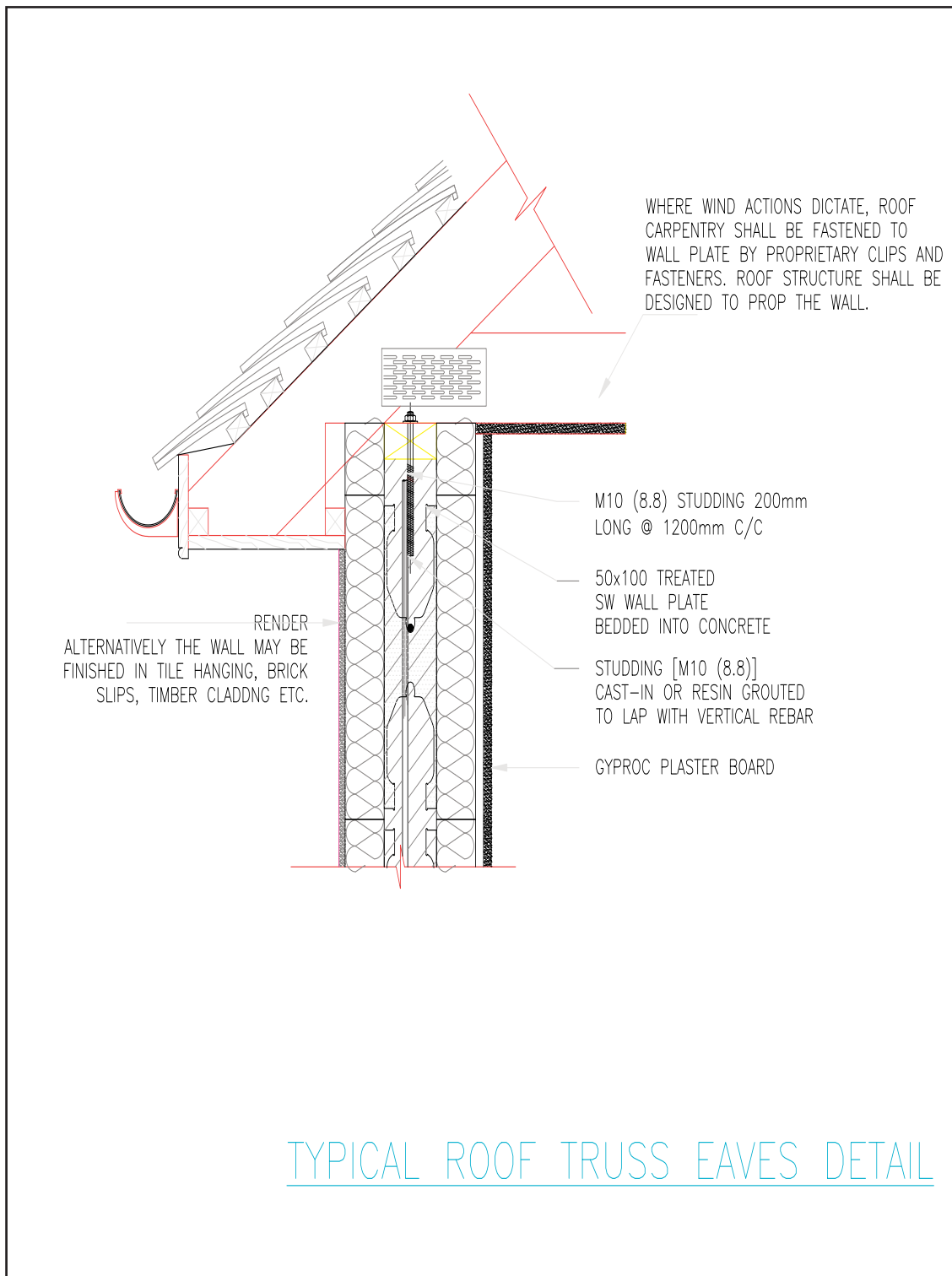


Fig 68 - Roof truss - eaves level

8.5 RAISED COLLAR - EAVES DETAIL

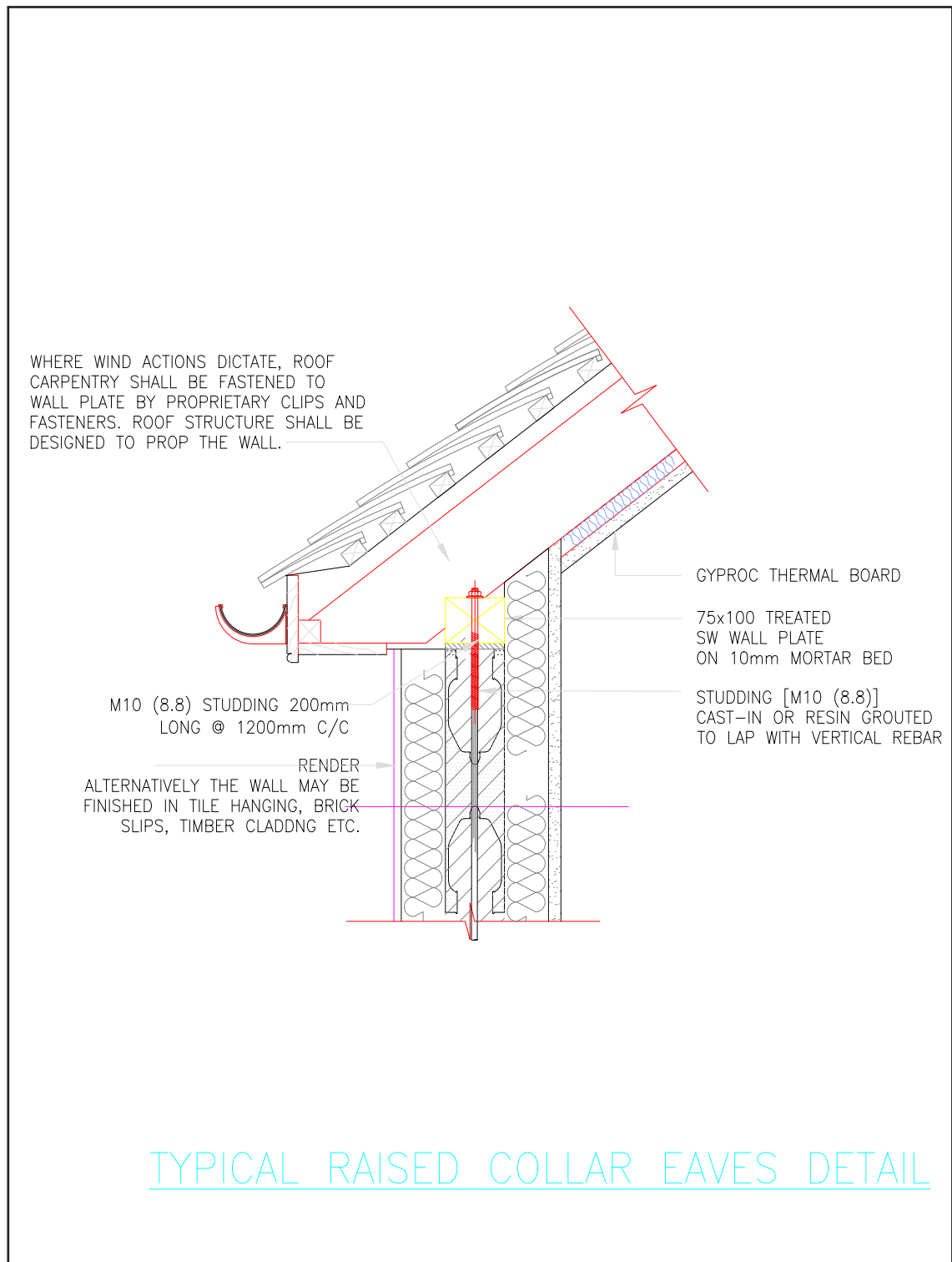


Fig 69 - Raised collar - eaves detail

8.6 TRUSS ROOF

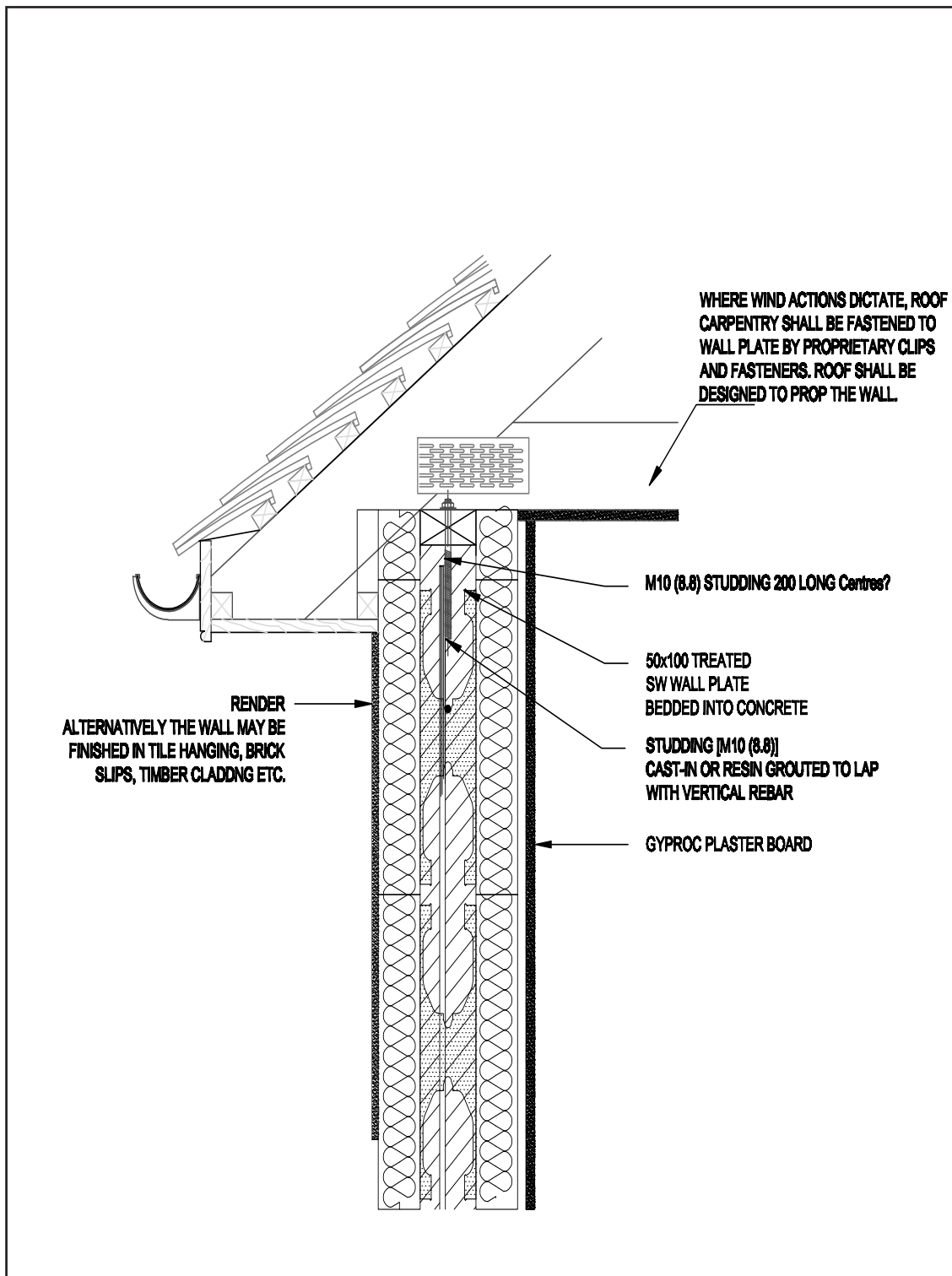


Fig 70 - Truss roof

8.7 HOUSEFORM 100 (SF100)

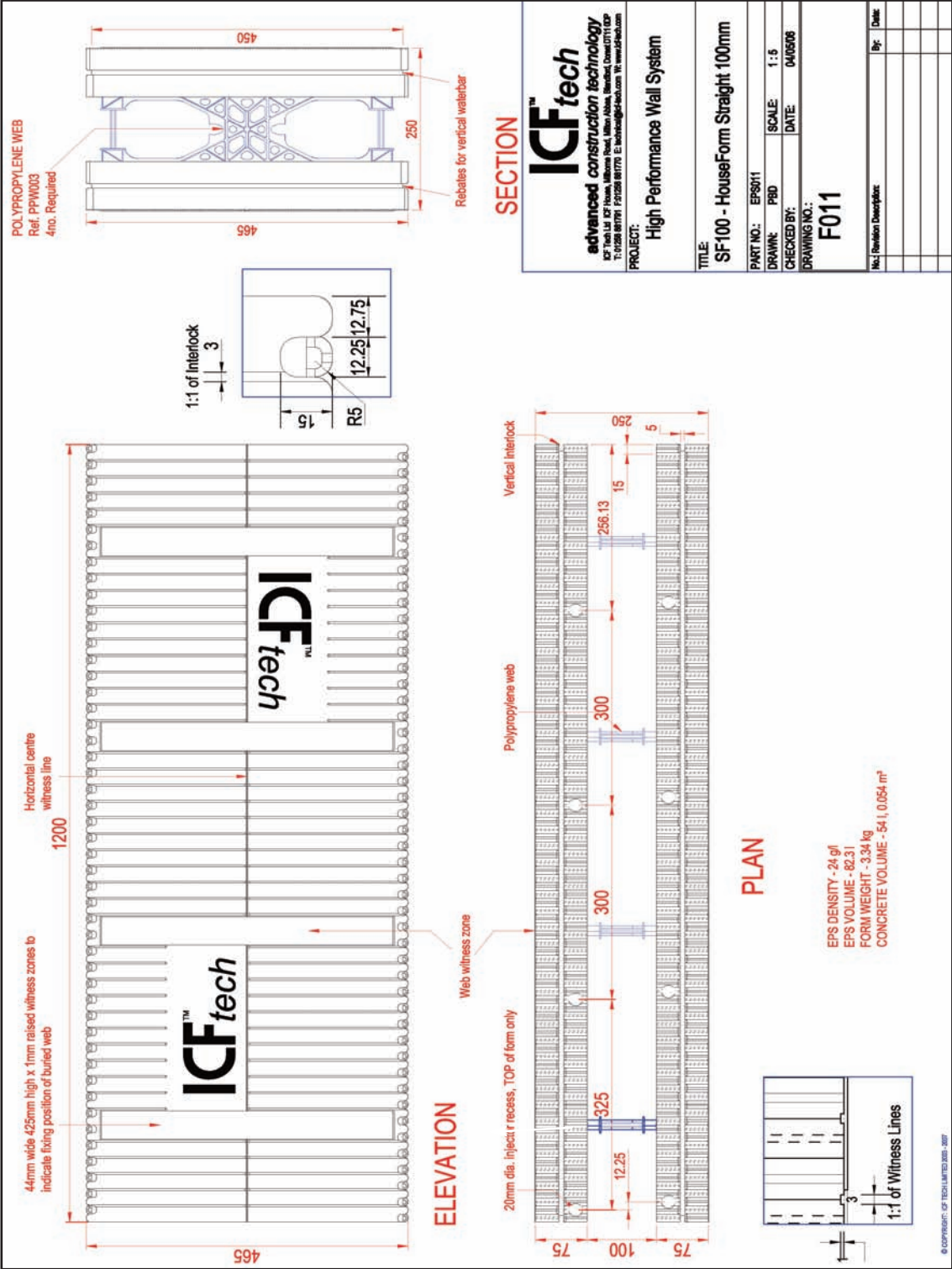


Fig 71 - HouseForm 100mm (SF100)

8.8 HOUSEFORM 150 (SF150)

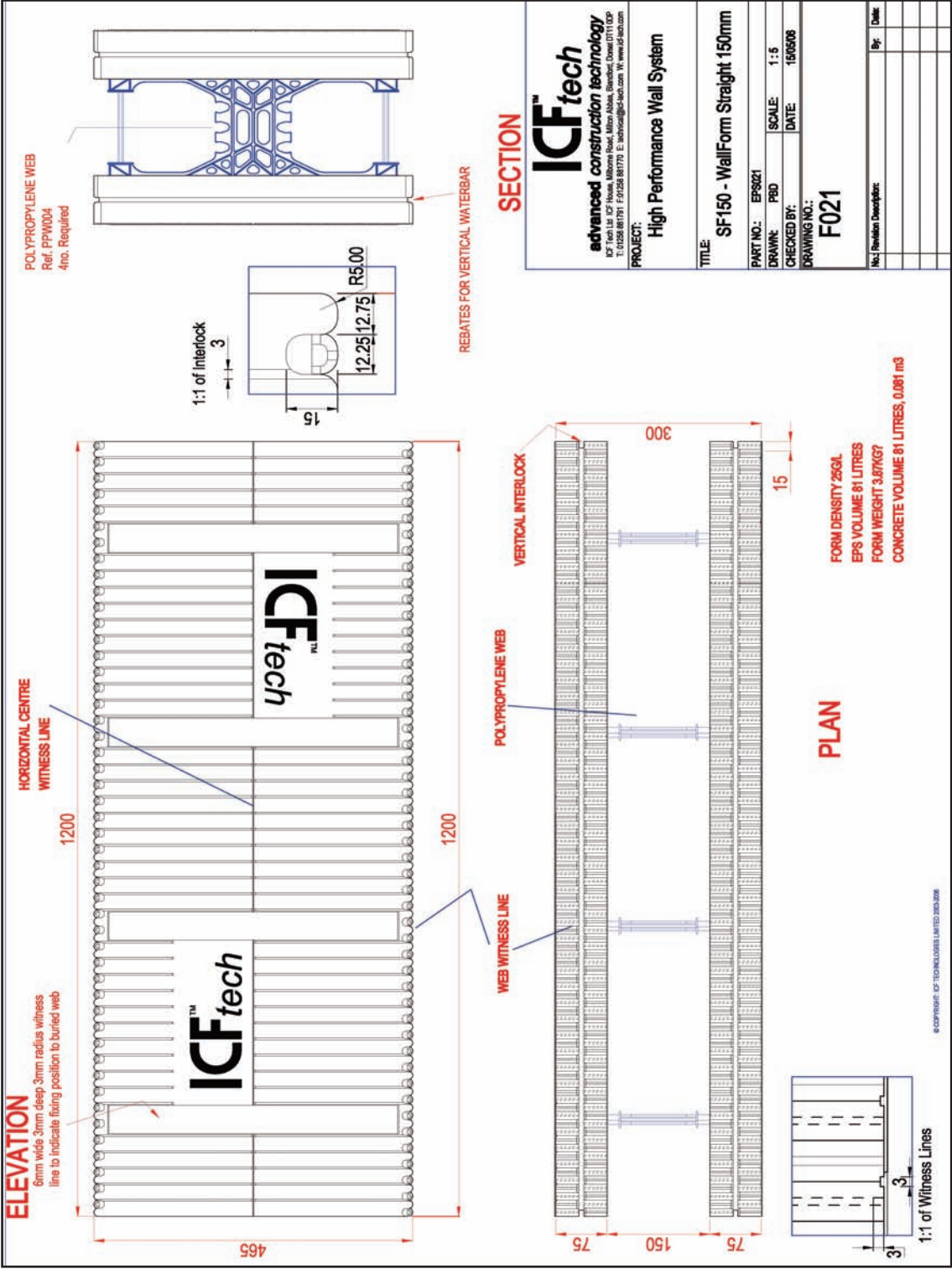


Fig 72 - WallForm 150 (SF150)

8.9 CORNERFORM 100 (ICF100)

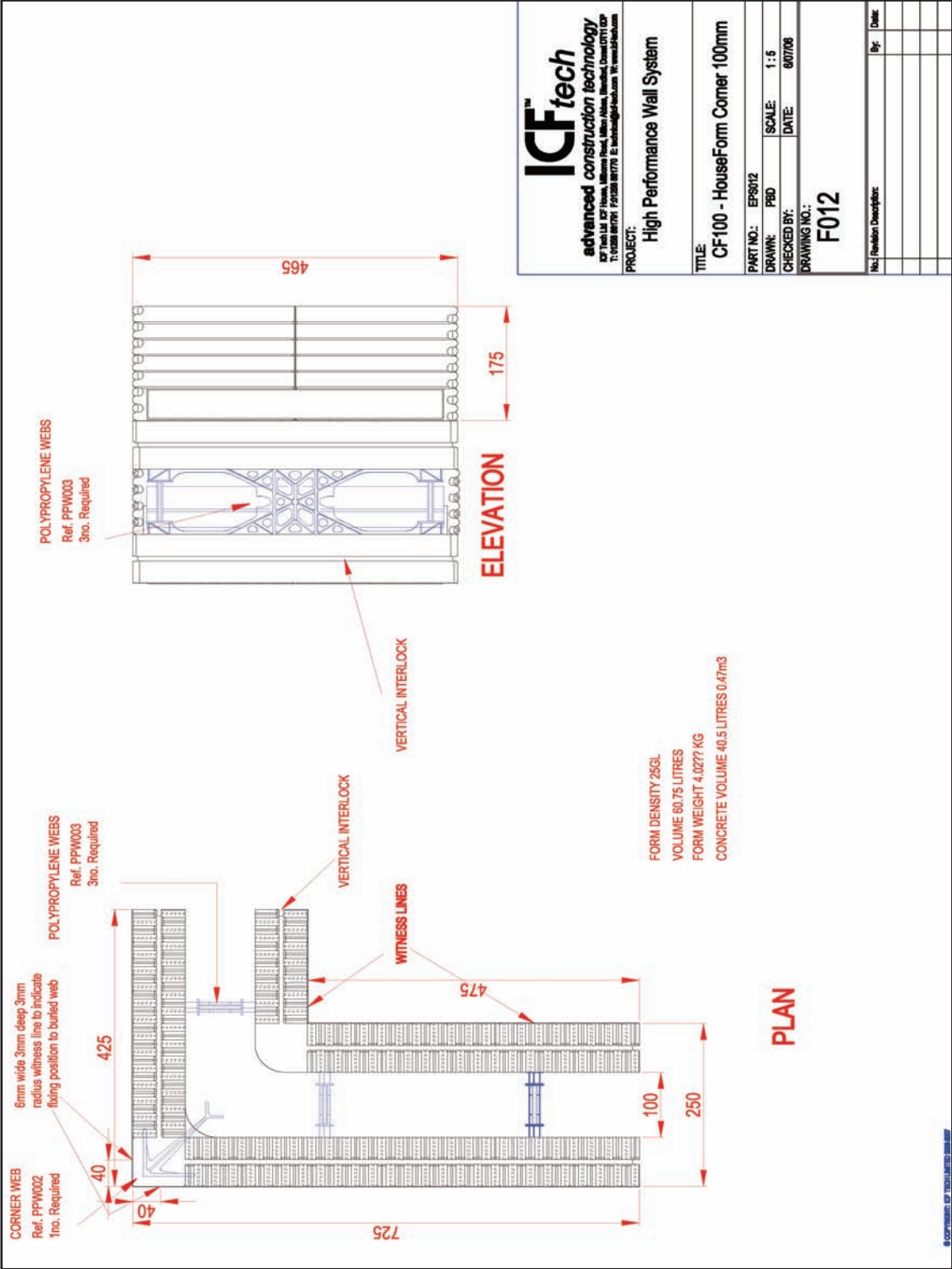


Fig 73 - CornerForm 100 (ICF100)

8.10 CORNERFORM 150 (ICF150)

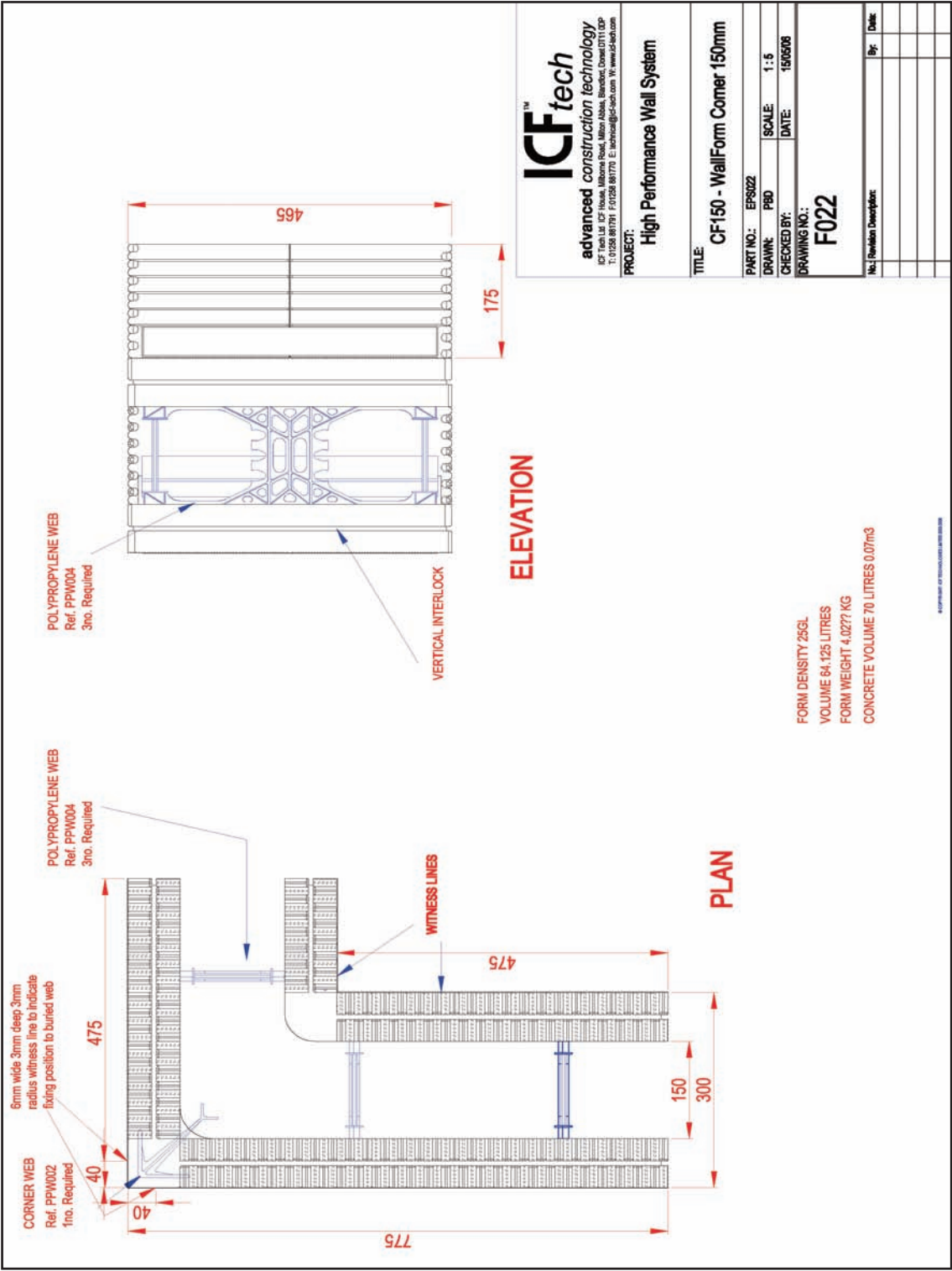


Fig 74 - CornerForm 150 (ICF150)

8.11 FLOORFORM 100 (FF100)

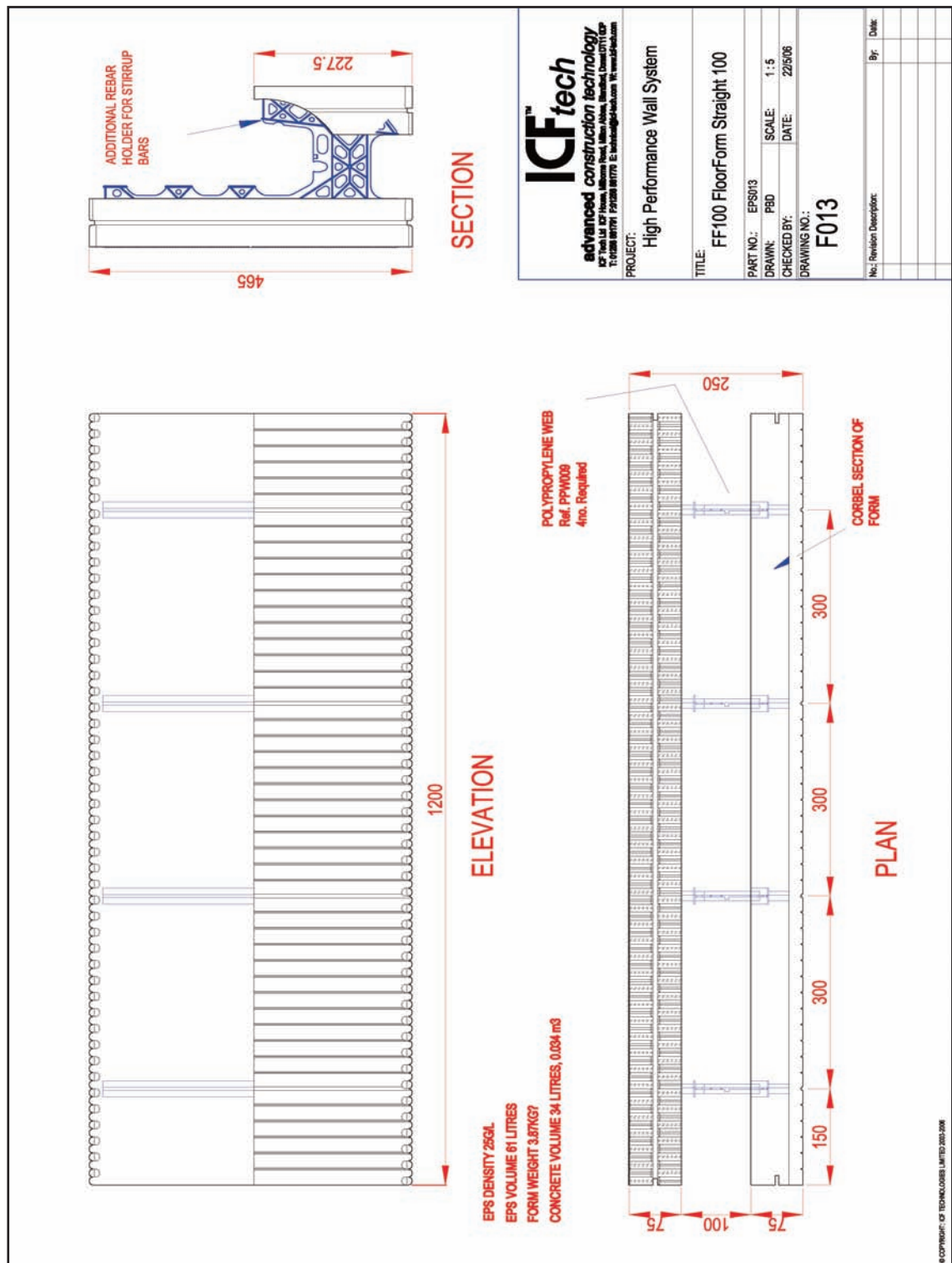


Fig 75 - FloorForm 100 (FF100)

8.12 FLOORFORM 150 (FF150)

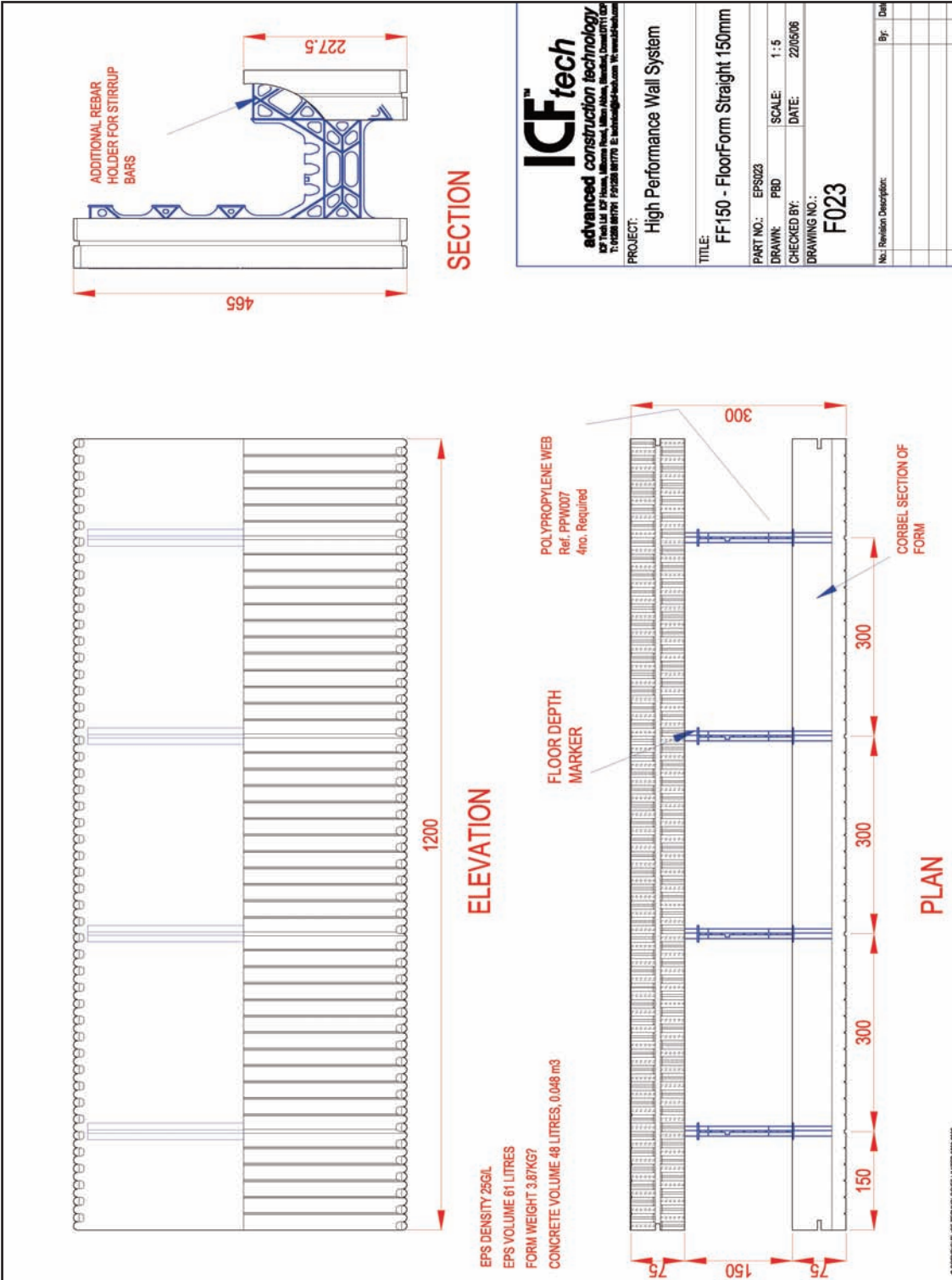


Fig 76 - FloorForm 150 (FF150)

8.13 FLOORFORM EXT. CORNER 100 (FFEC100)

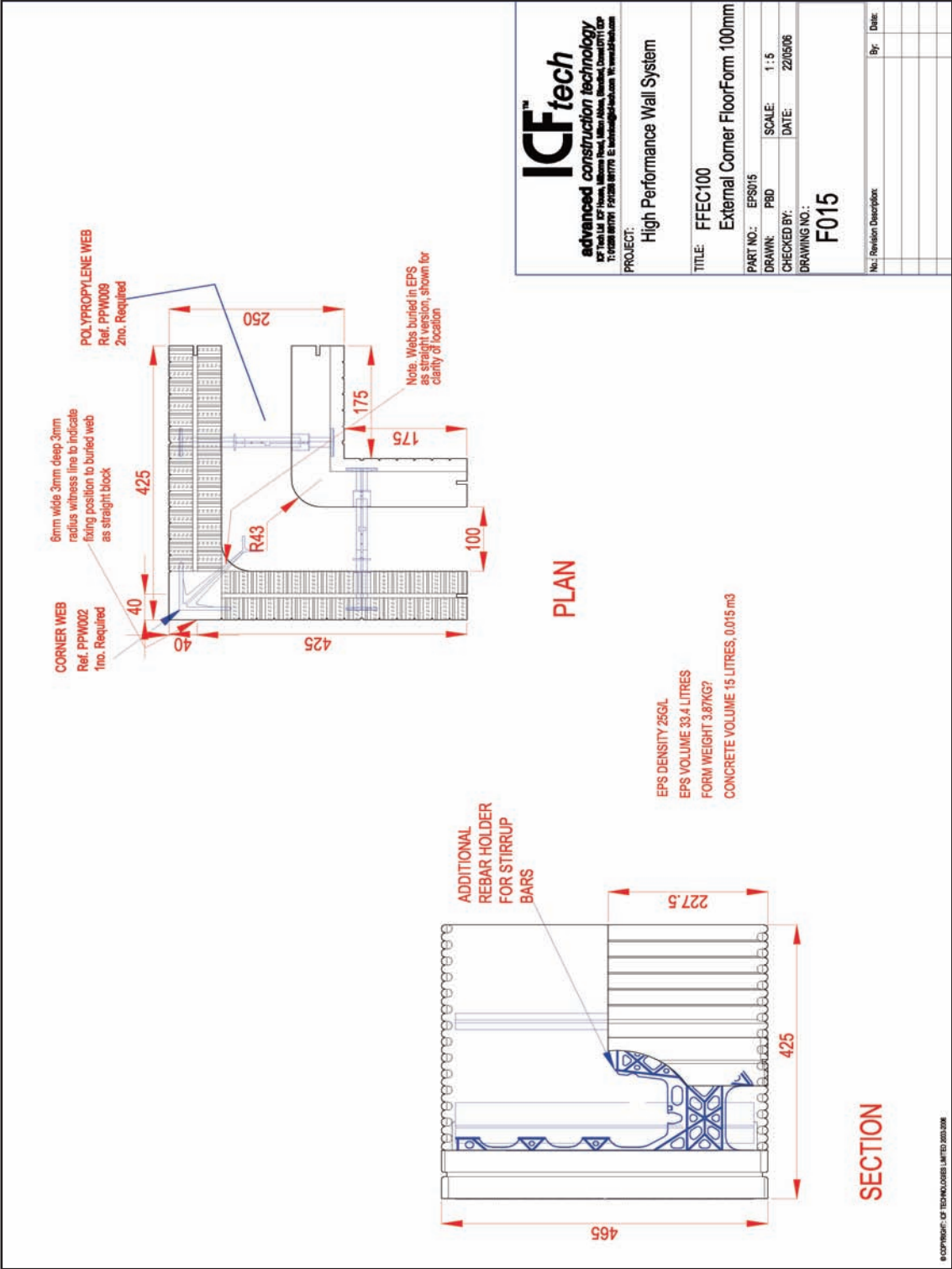


Fig 77 - FloorForm ext. Corner (FFEC100)

8.15 FLOORFORM INT. CORNER 100 (FFIC100)

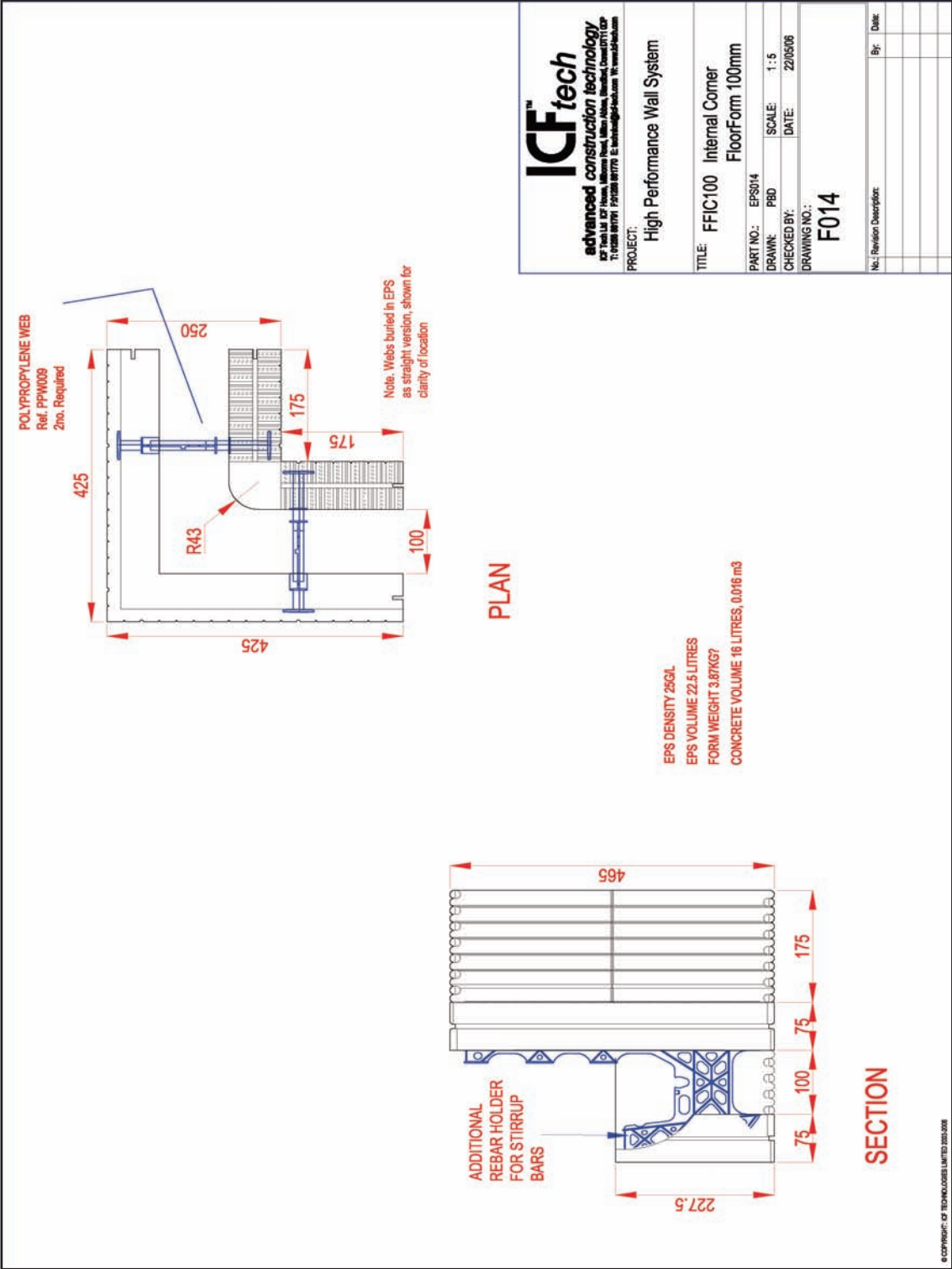


Fig 79 - FloorForm int. Corner 100 (FFIC100)

8.16 FLOORFORM INT. CORNER 150 (FFIC150)

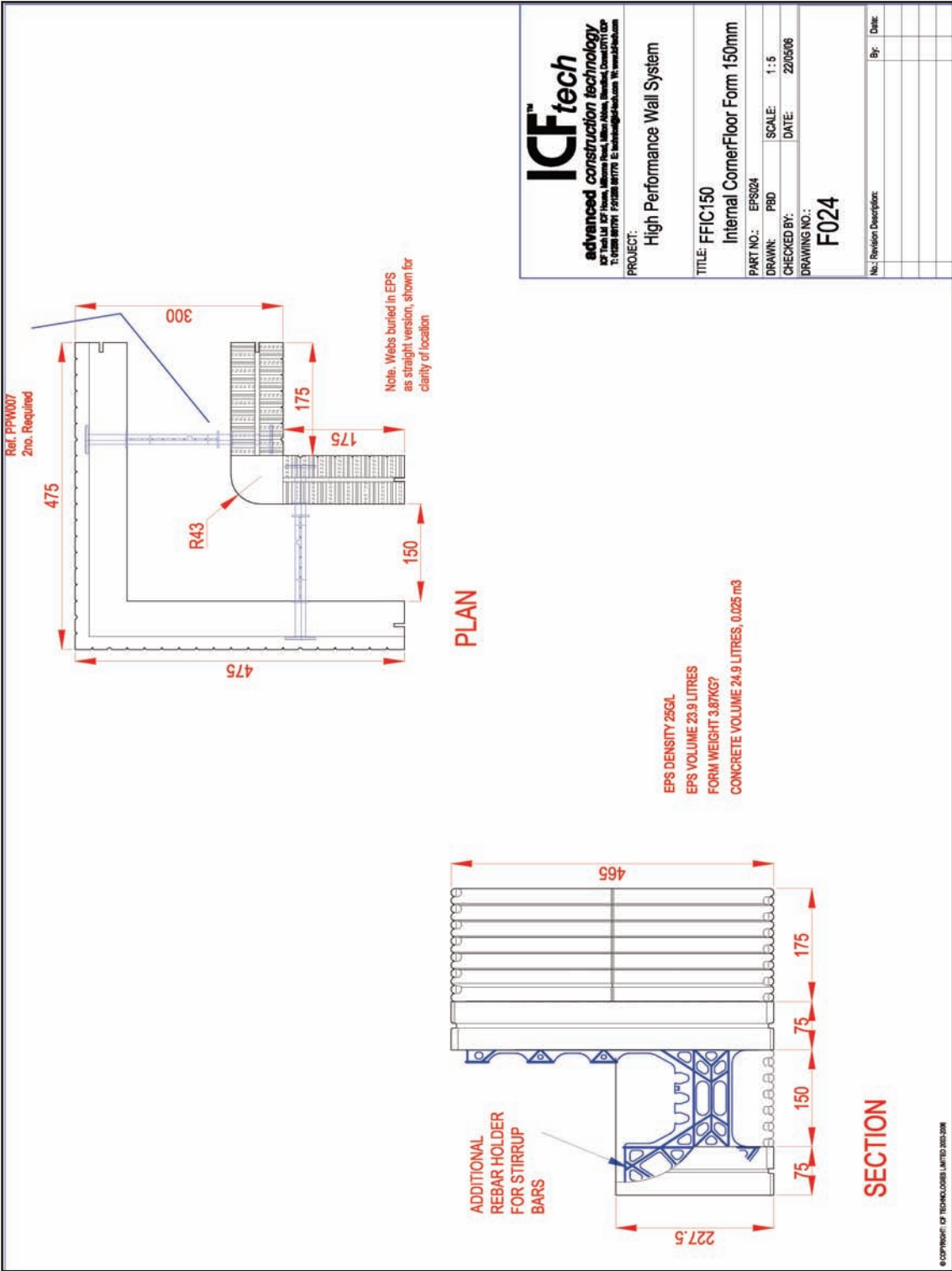


Fig 80 - FloorForm int. Corner 150 (FFIC150)

8.17 REBAR CRADLE

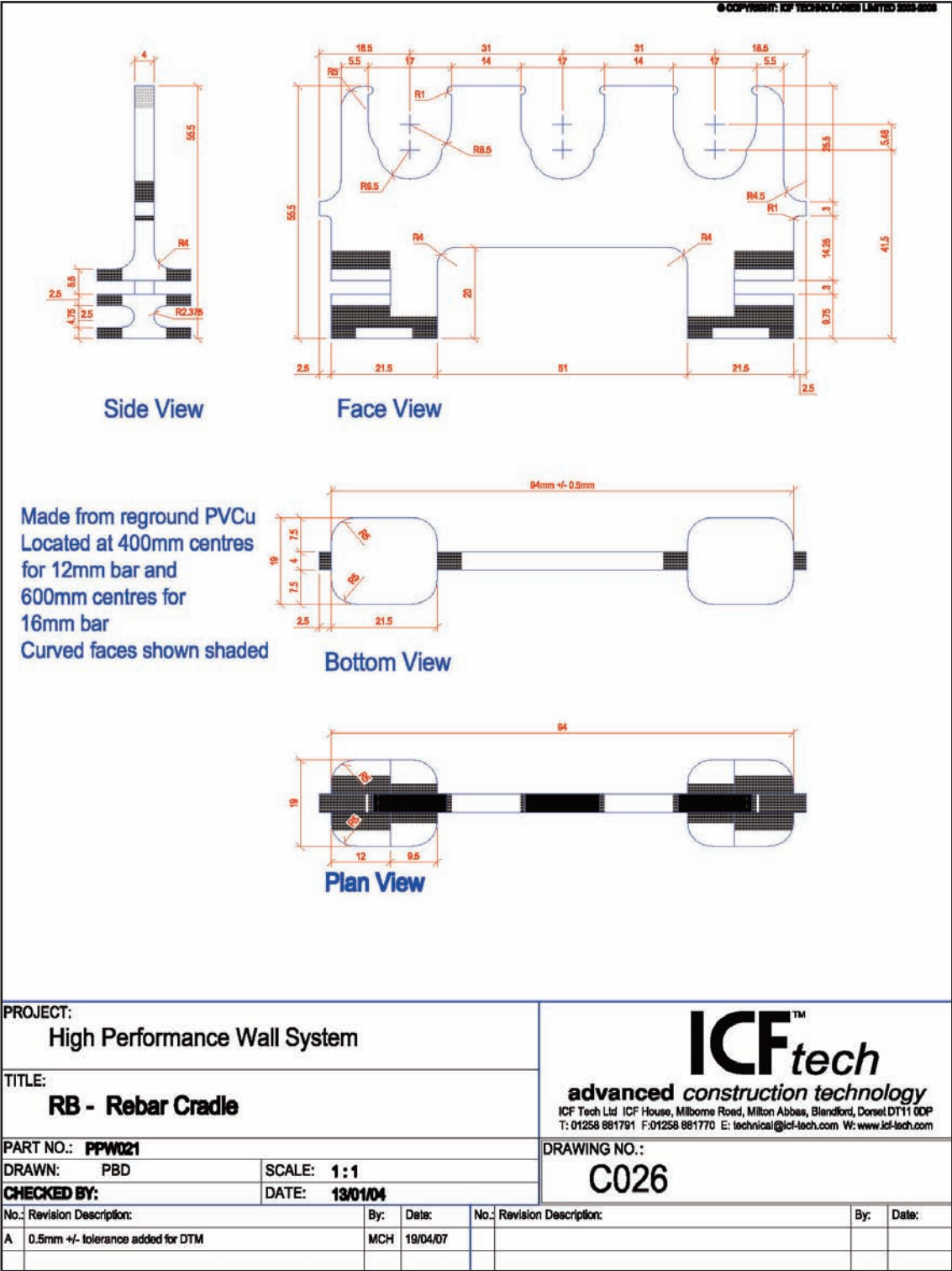


Fig 81 - Rebar Cradle

8.18 FORMCLOSER

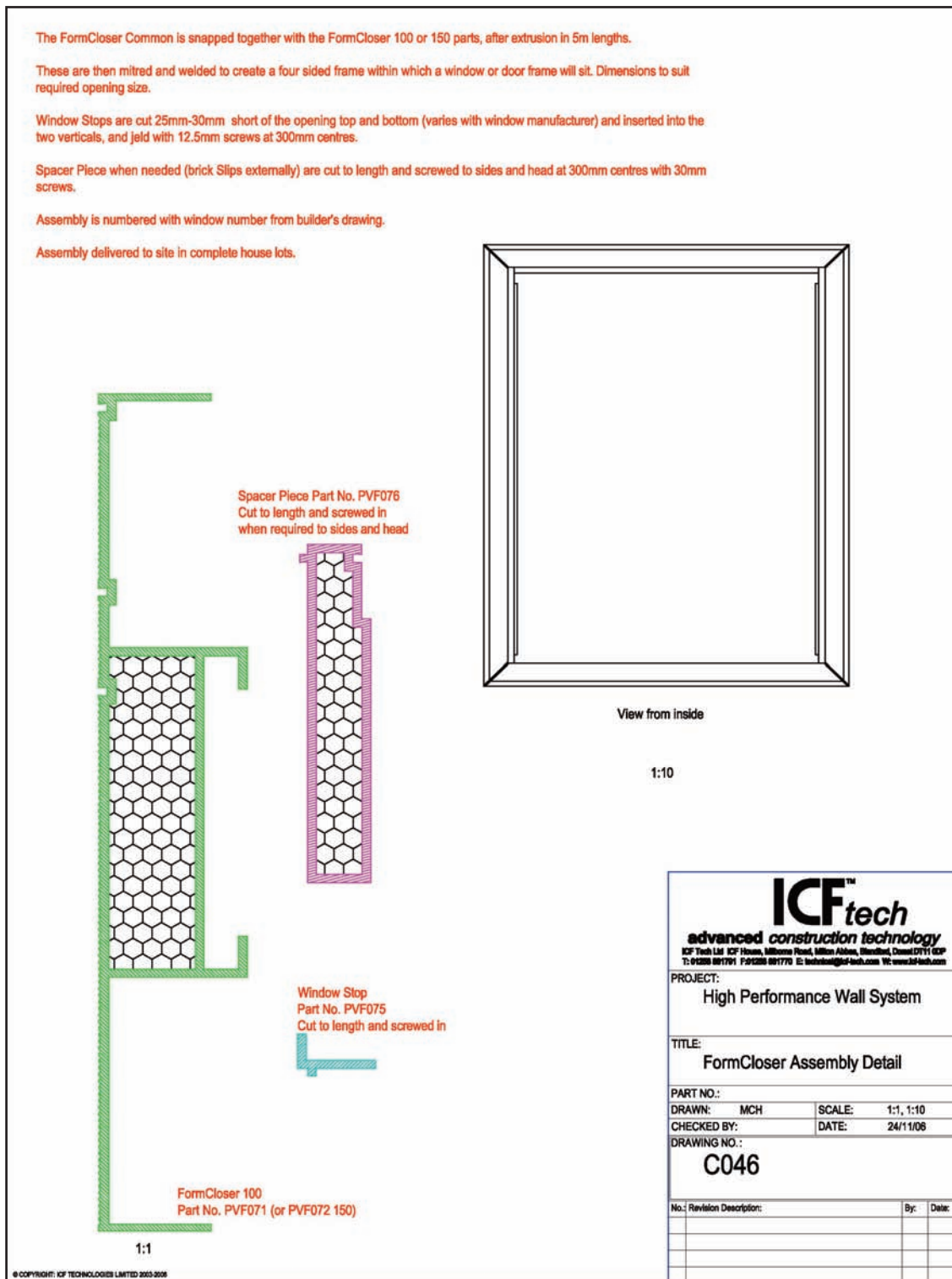


Fig 82 - FormCloser

8.19 FORMCLOSER ASSEMBLY DETAILS - 1

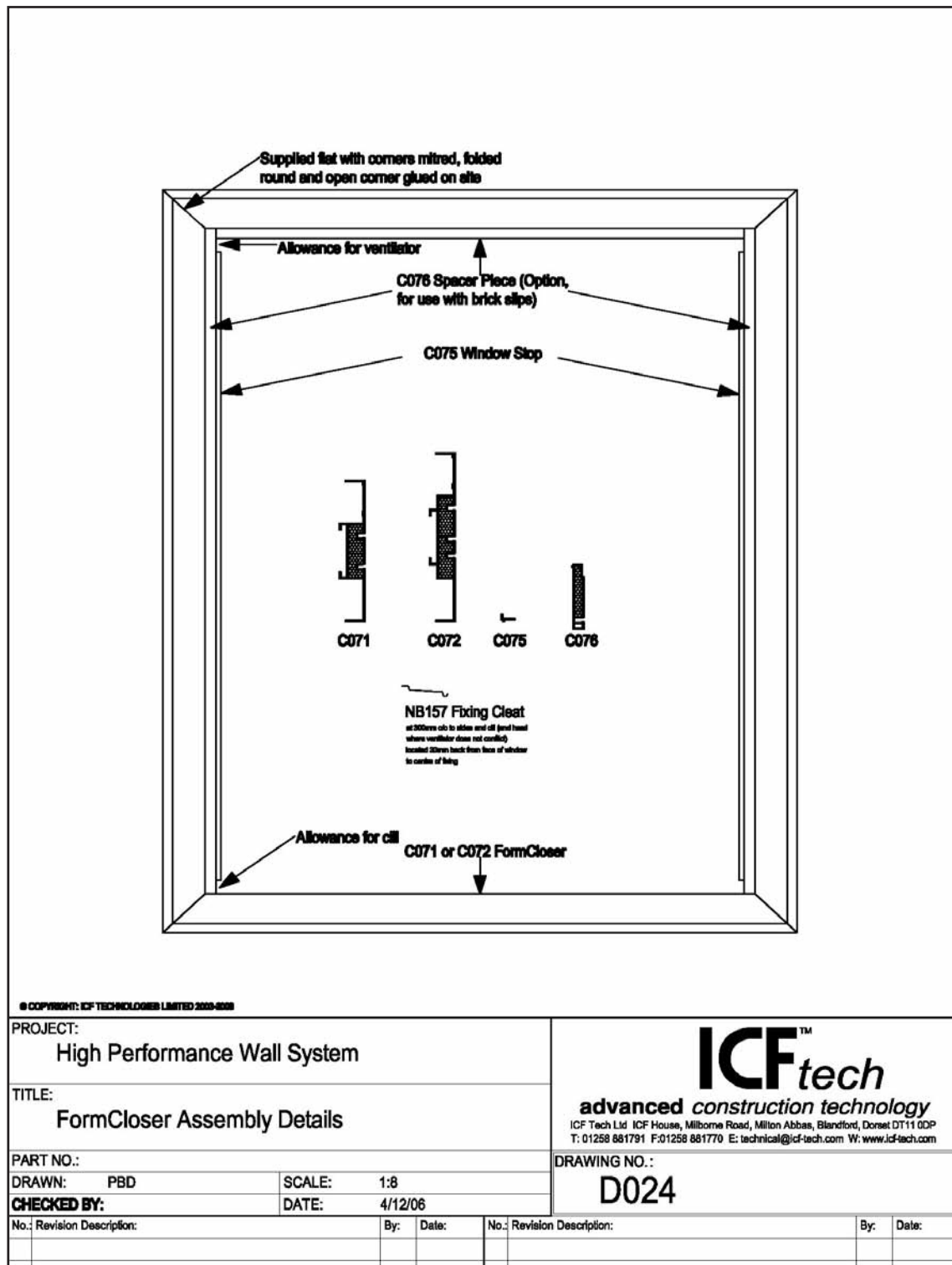


Fig 83 - FormCloser assembly details - 1

8.20 FORMCLOSER ASSEMBLY DETAIL - 2

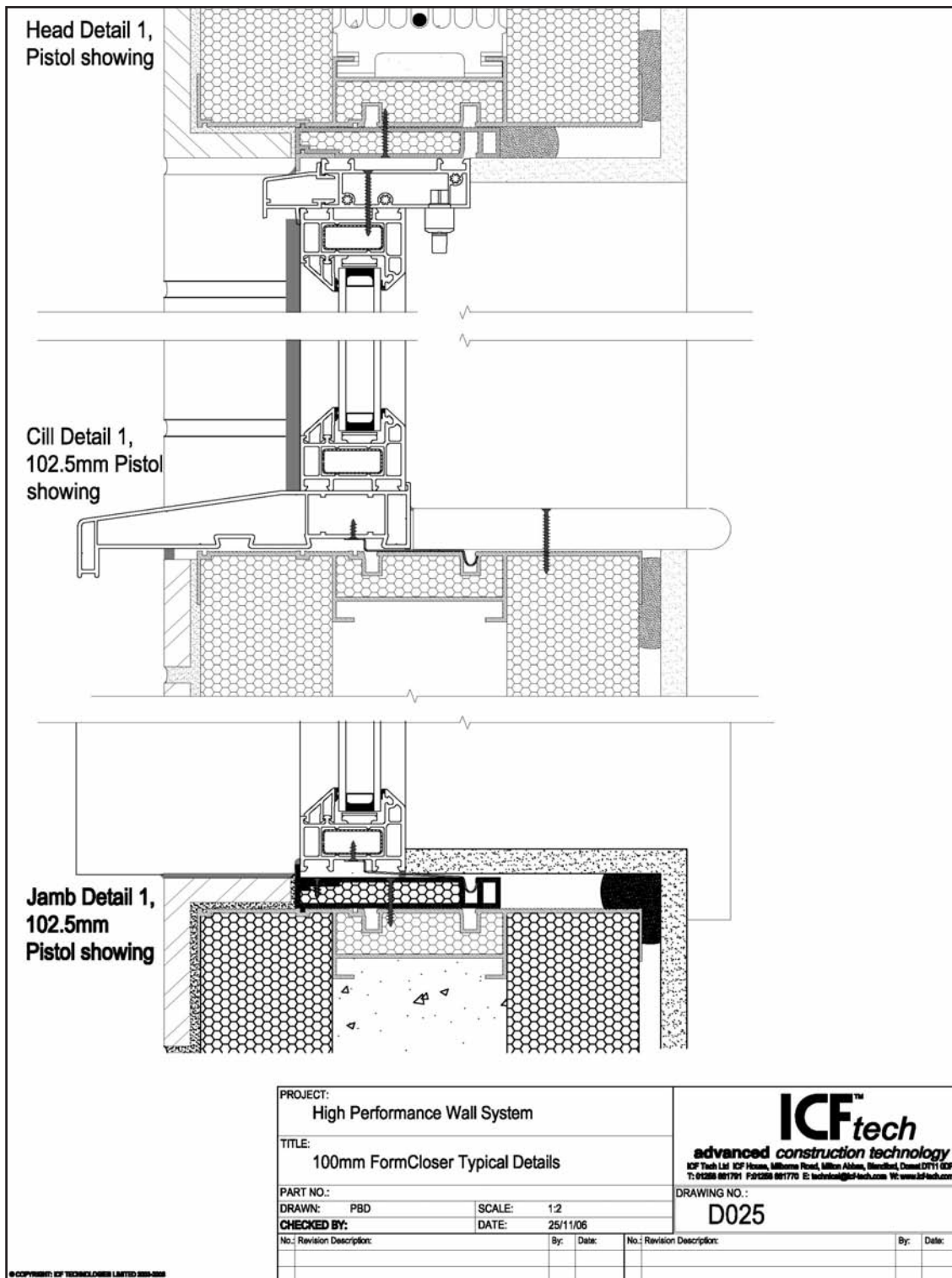


Fig 84 - FormCloser assembly detail - 2

8.21 DETAIL FOR VERTICAL TILE HANGING

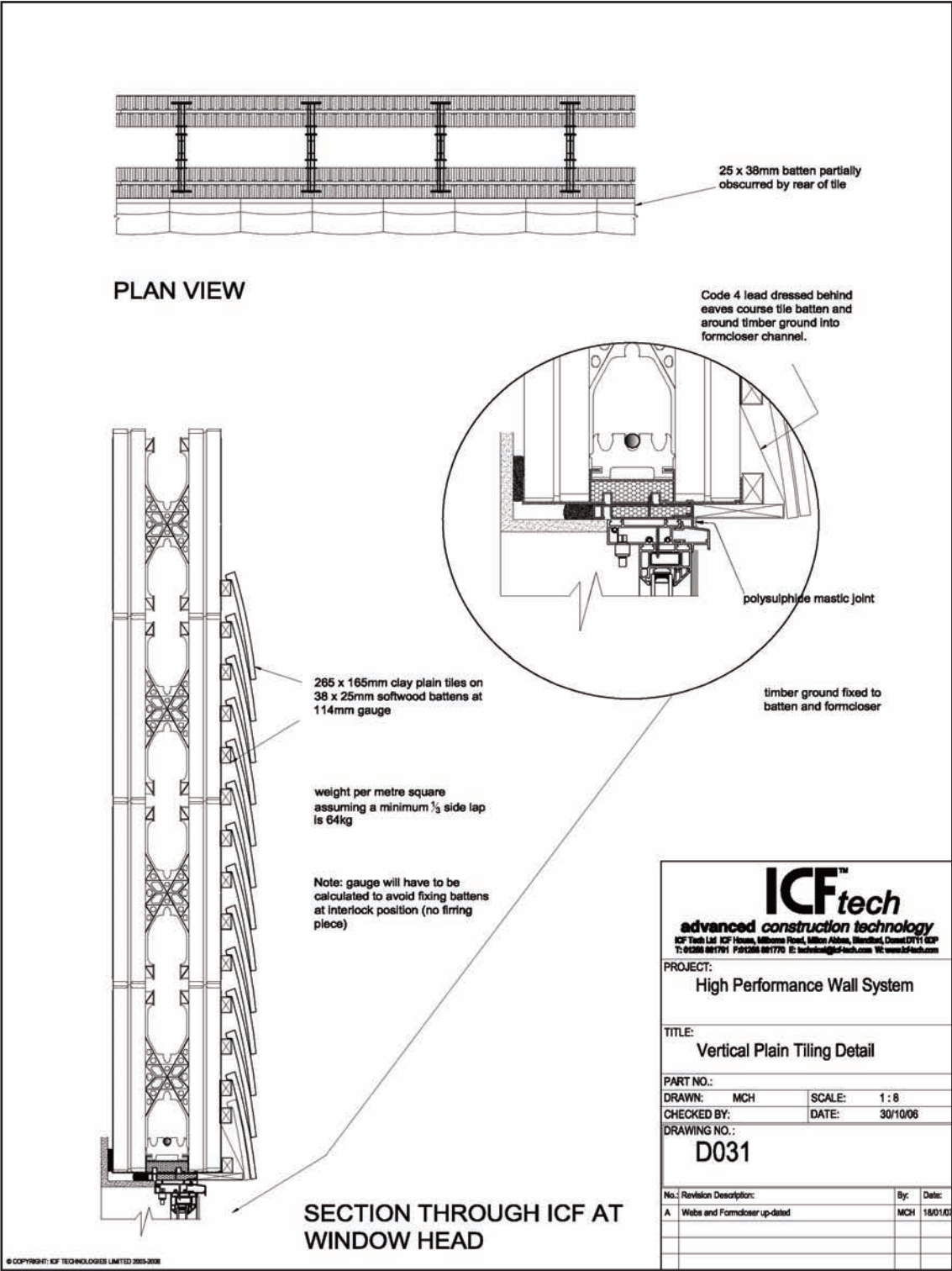


Fig 85 - Detail for vertical tile hanging

8.23 SIRPEC

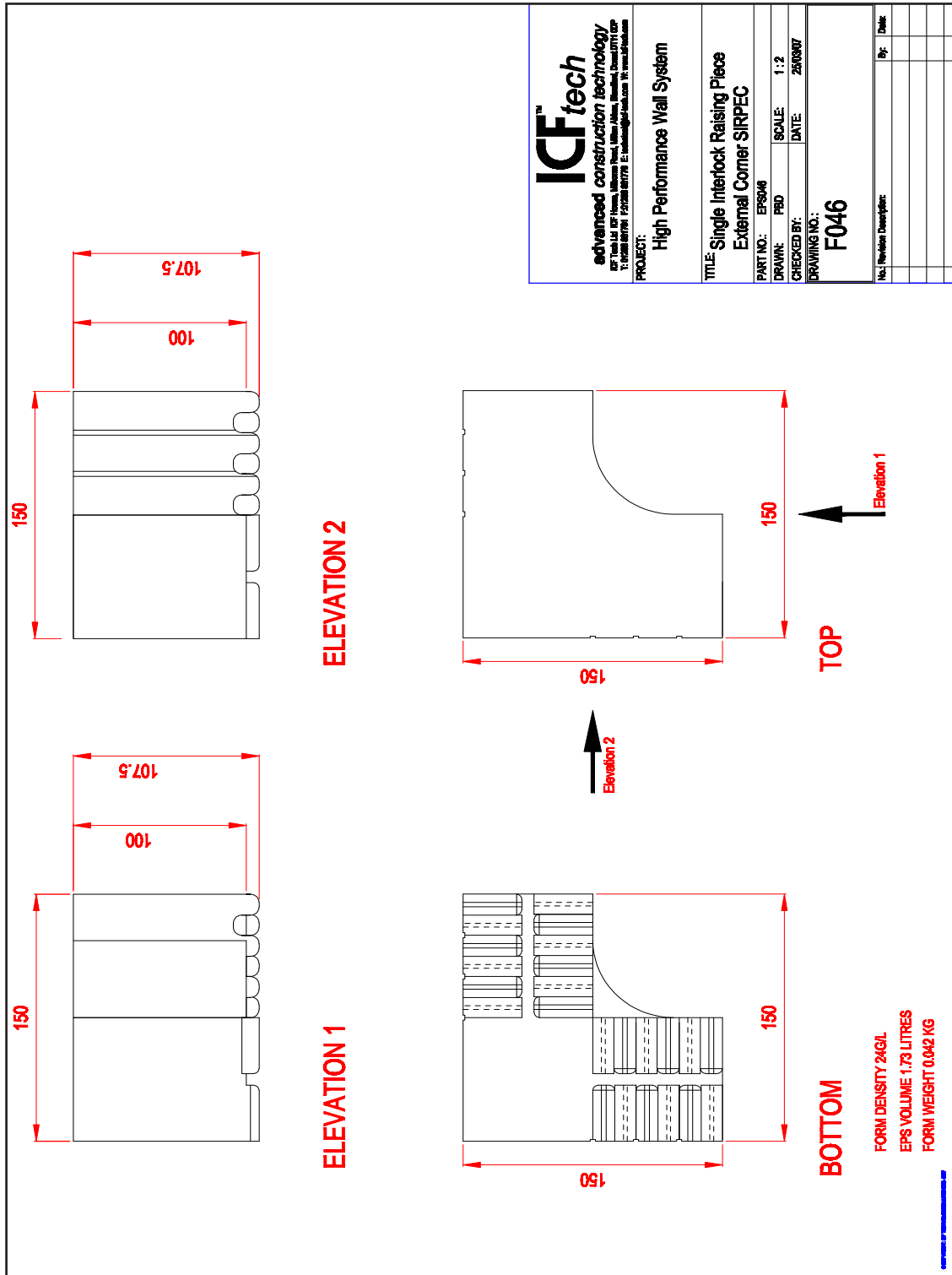


Fig 86 - Hanson Jetfloor - section taken where planks spans parallel to ICF wall

8.24 SIRPIC

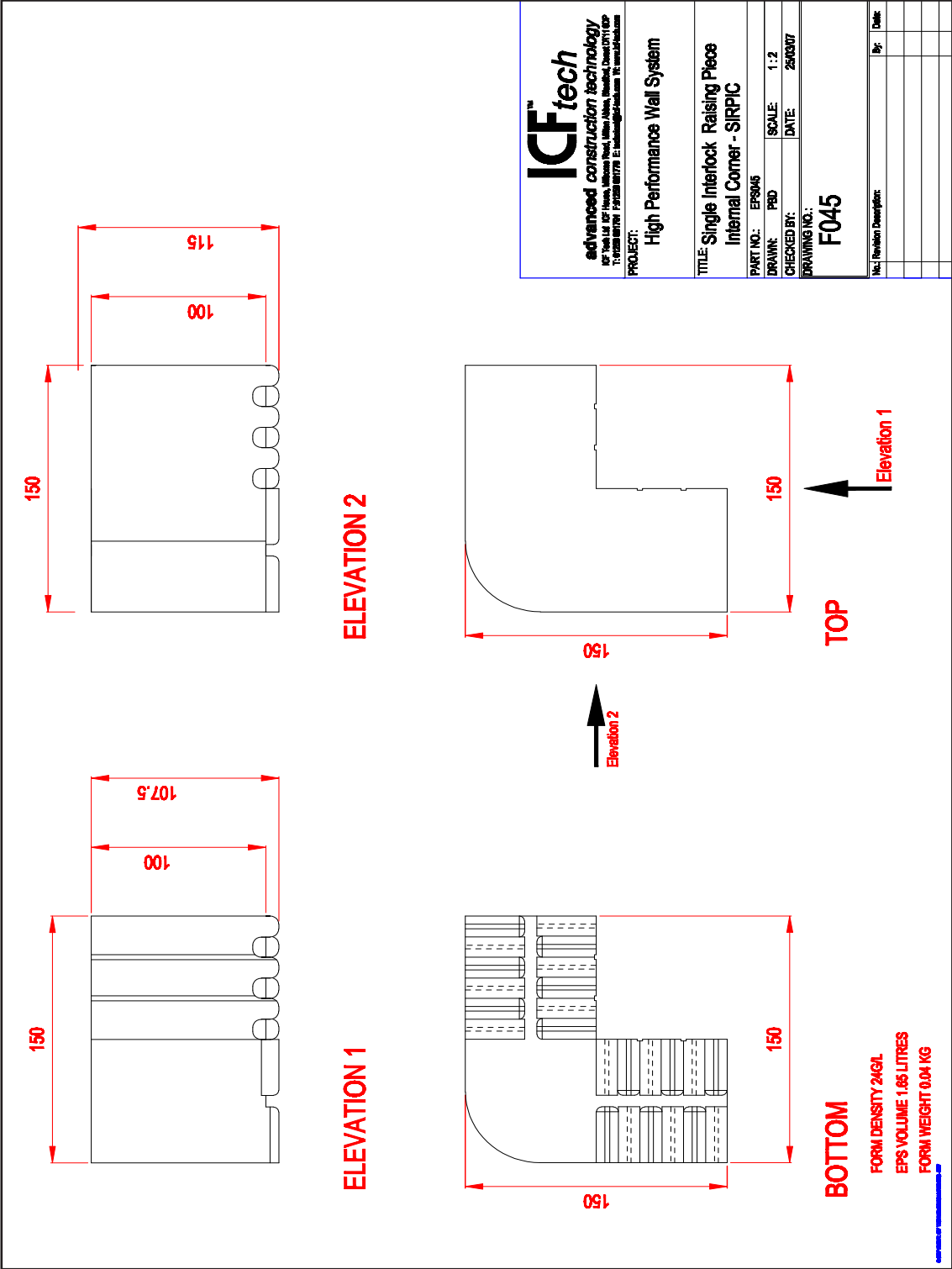


Fig 87 - Hanson Jetfloor - section taken where planks spans parallel to ICF wall

8.25 SIRP

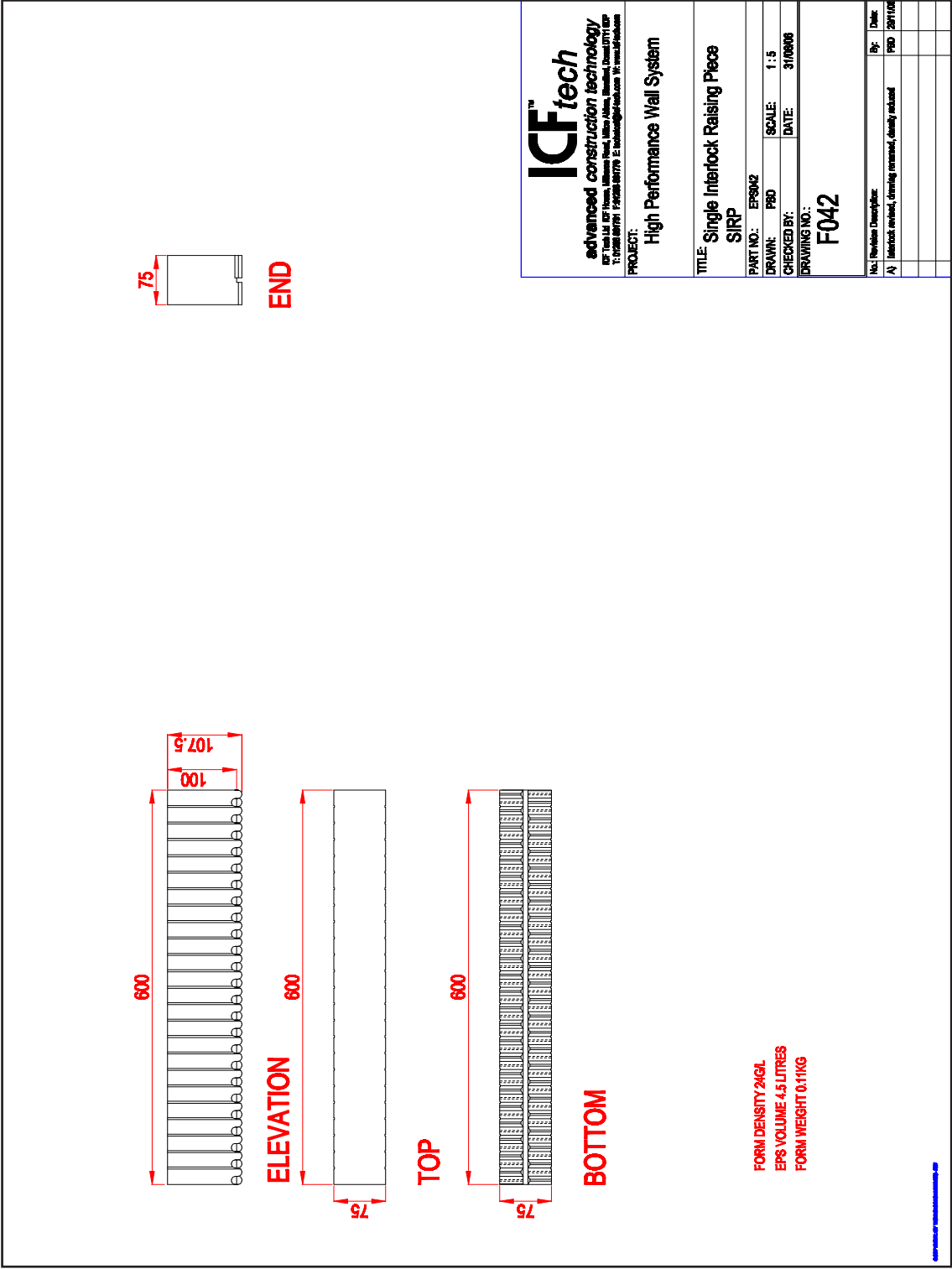


Fig 88 - Hanson Jetfloor - section taken where planks spans parallel to ICF wall

8.24 DIRP

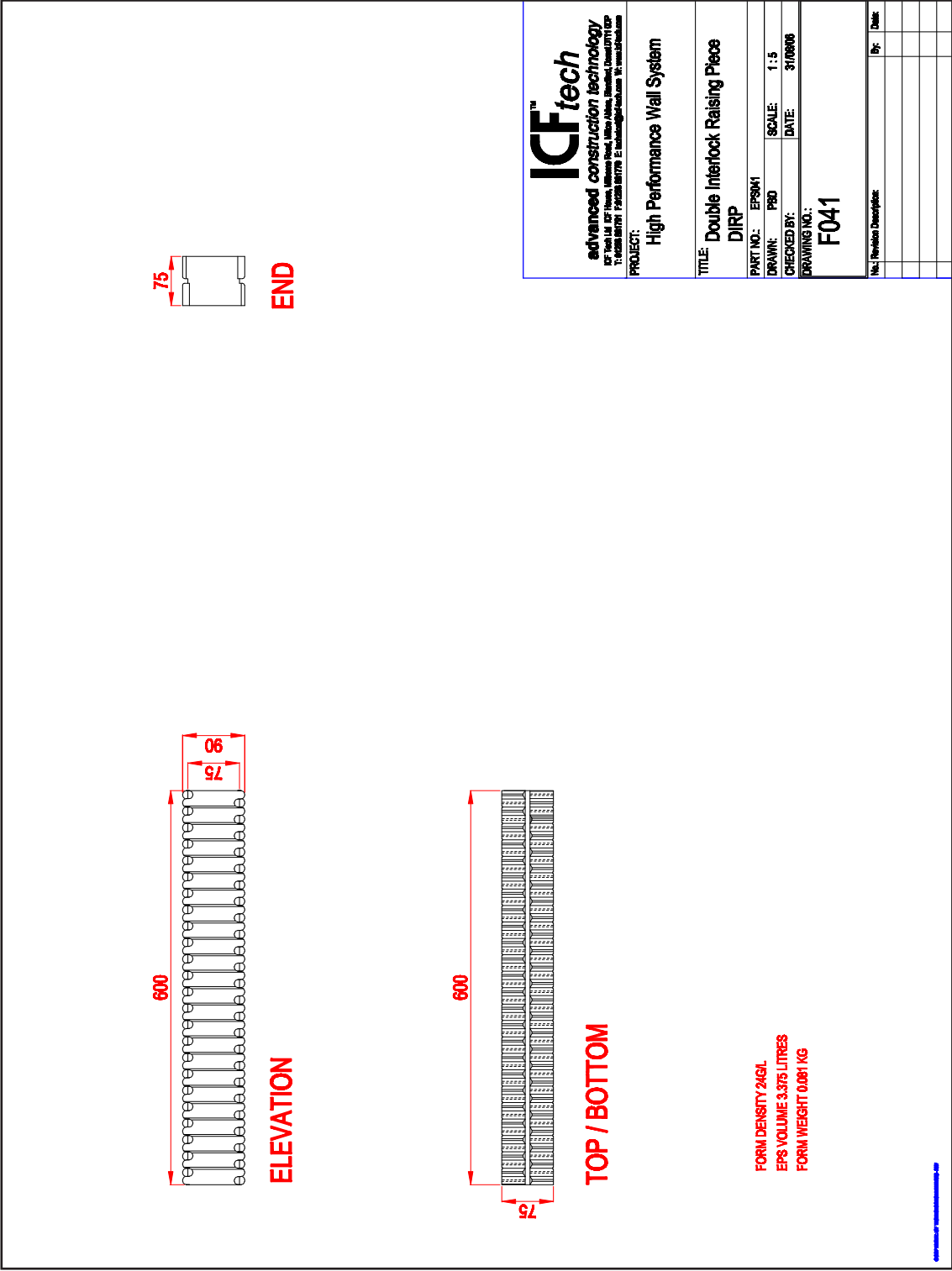
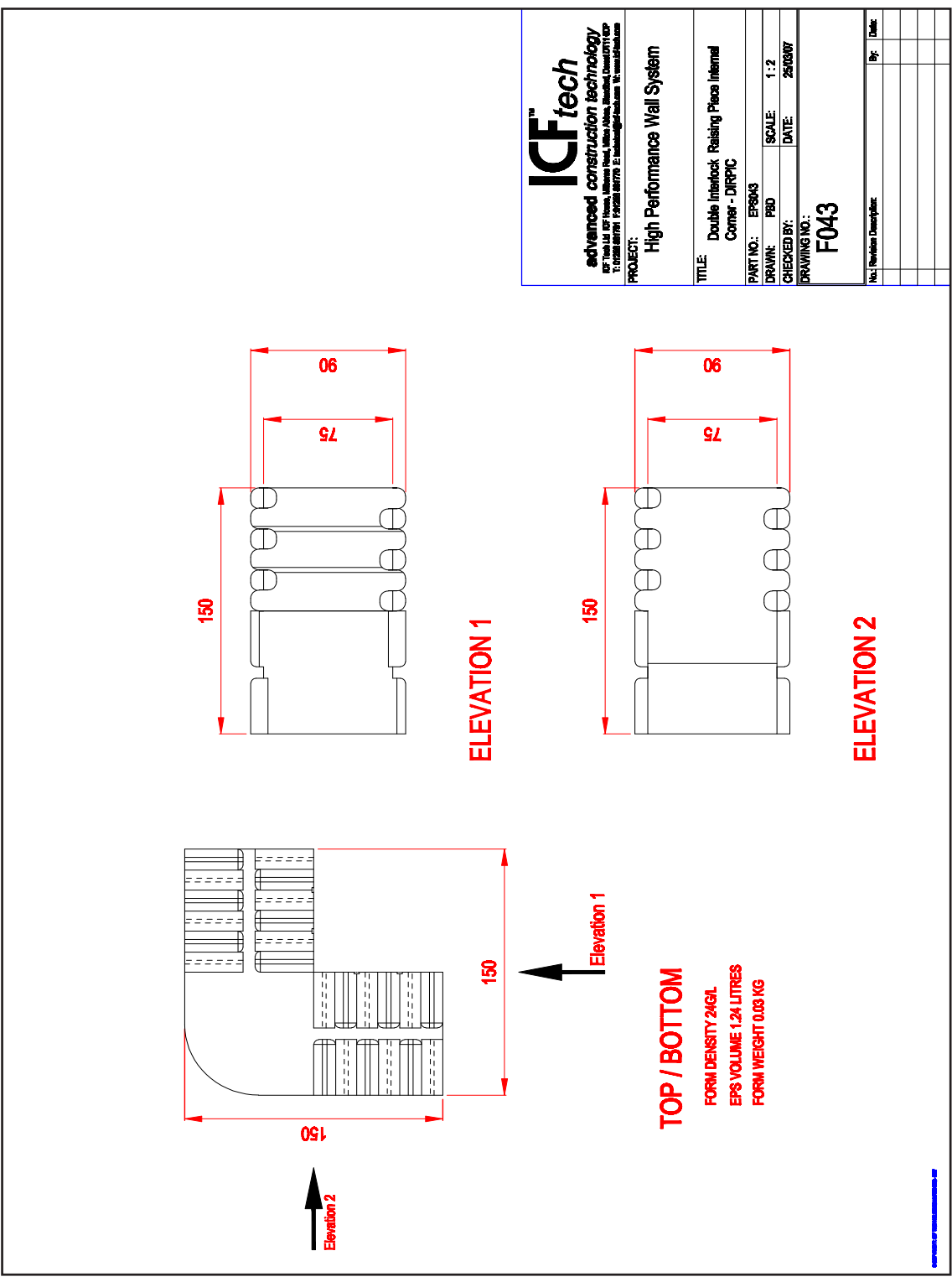


Fig 89 - Hanson Jetfloor - section taken where planks spans parallel to ICF wall

8.25 DIRPIC



8.26 DIRPEC

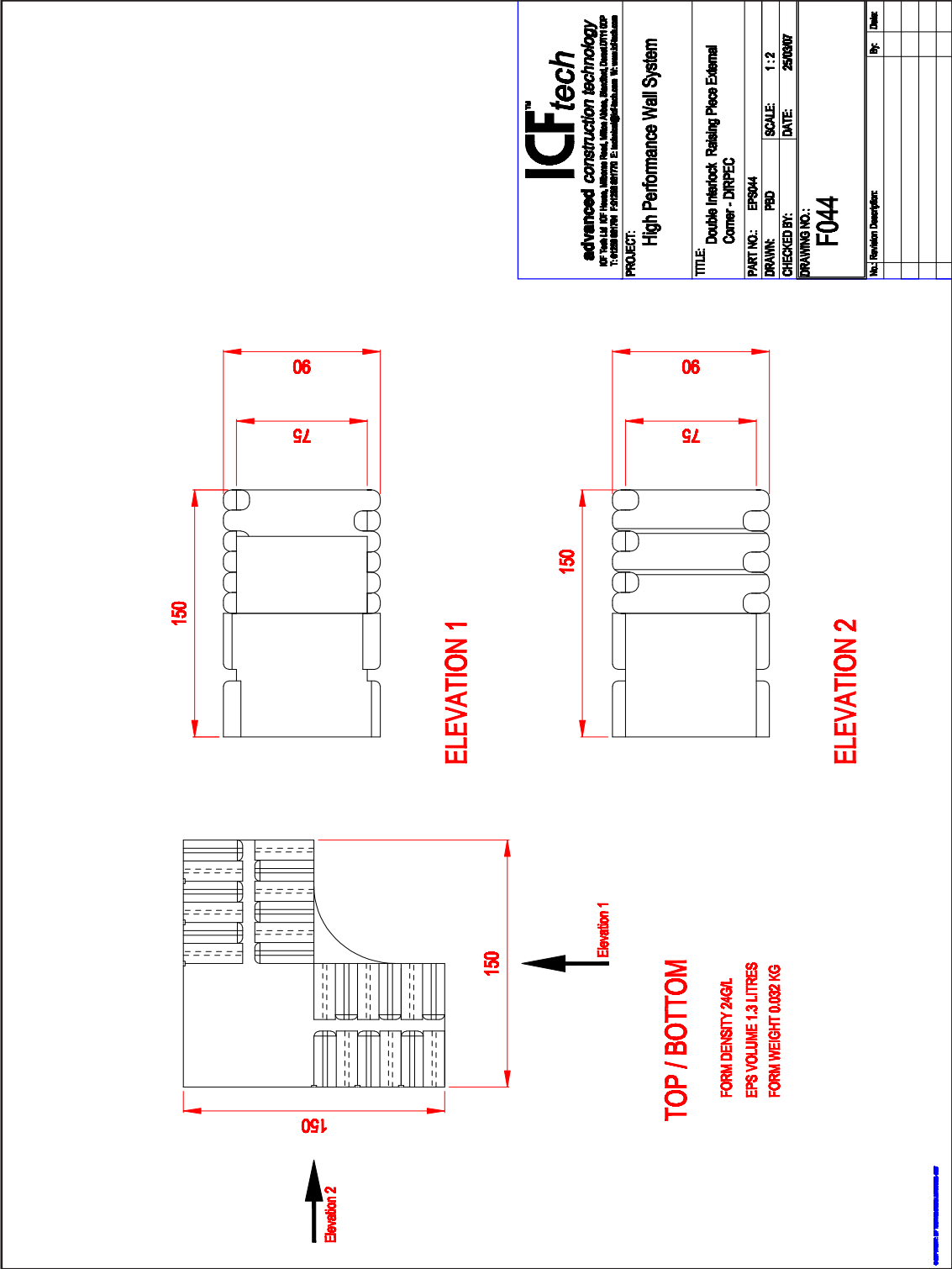
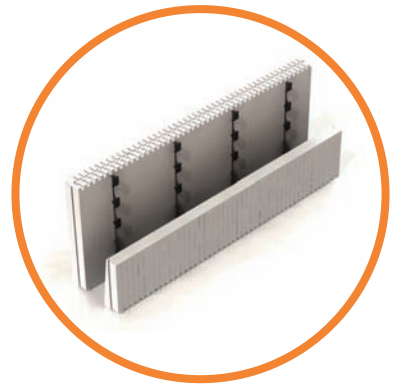
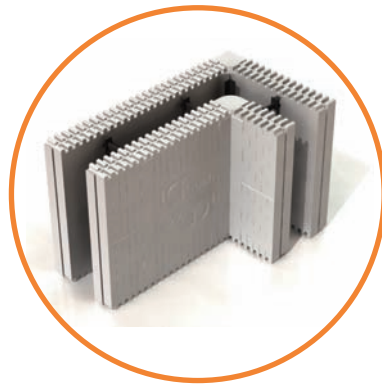
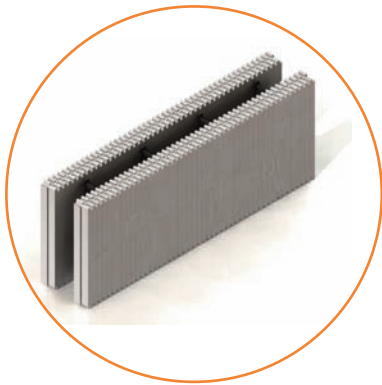


Fig 91 - Hanson Jetfloor - section taken where planks spans parallel to ICF wall

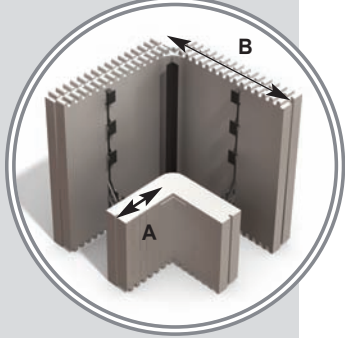
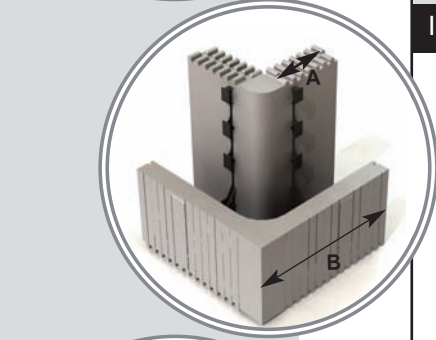
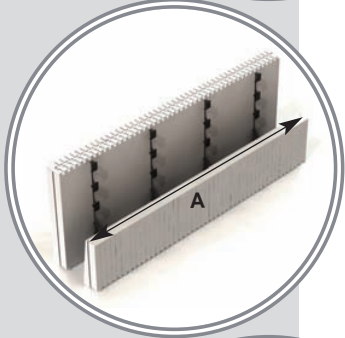
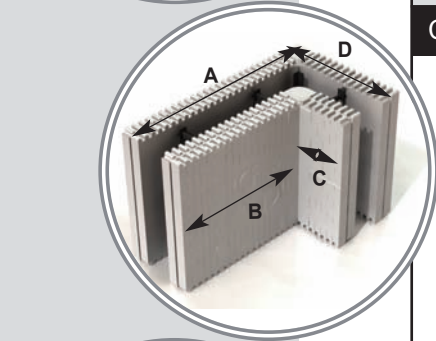
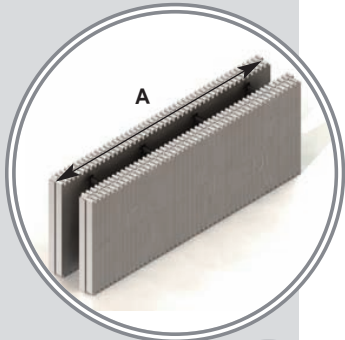
this page left intentionally blank



9

Form specifications

HouseForm - *the domestic choice*



length*	length (return)	surface area (ext. face)m ²	surface area (int. face)m ²	concrete volume m ³
Straight - SF100				
1200 ^A	na	0.54	0.54	0.054
Corner - ICF100				
725 ^A 475 ^B	425 ^D 175 ^C	0.52	0.29	0.040
FloorForm - FF100				
1200 ^A	na	0.54	0.273	(0.033)
Internal Corner FloorForm - FFIC100				
425 ^B	175 ^A (ext. face)	0.160	0.140	(0.010)
External Corner FloorForm - FFEC100				
425 ^B (ext. face)	175 ^A	0.038	0.080	(0.010)

* 1 - All dimensions are in mm

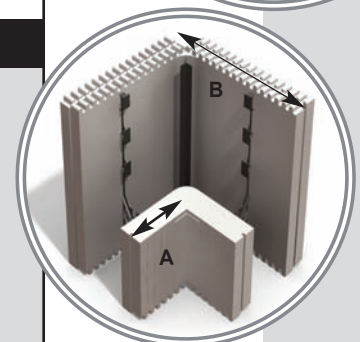
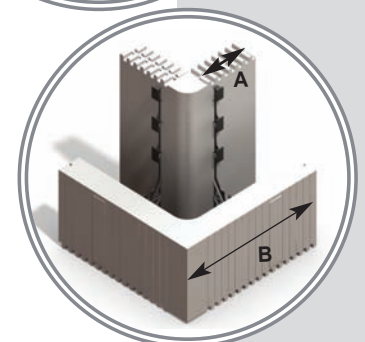
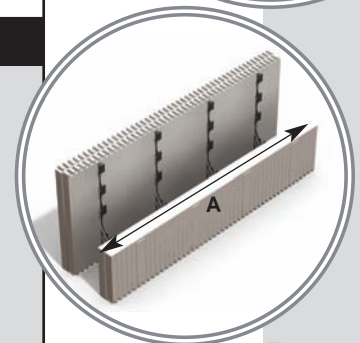
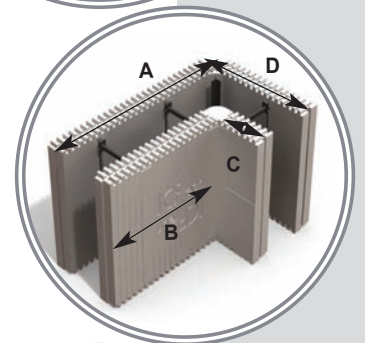
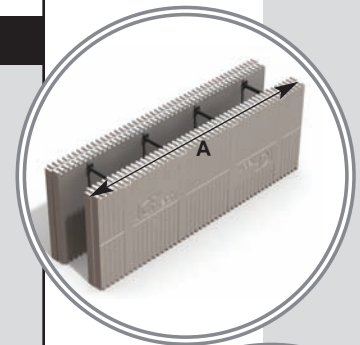
2 - All Forms are 465mm high (450mm when joined together)

3 - HouseForms have a 100mm concrete core, two 75mm EPS skins - 250mm overall width

4 - All FloorForms have an internal height (from base to top of corbel) of 227.5mm

the commercial choice - WallForm

length*	length (return)	surface area (ext. face)m ²	surface area (int. face)m ²	concrete volume m ³
Straight - SF150				
1200 ^A	na	0.54	0.54	0.081
Corner - ICF150				
775 ^A 475 ^B	475 ^D 175 ^C	0.56	0.29	0.063
FloorForm - FF150				
1200 ^A	na	0.54	0.27	(0.047)
Internal Corner FloorForm - FFIC150				
475 ^B	175 ^A (ext. face)	0.160	0.22	(0.026)
External Corner FloorForm - FFEC150				
475 ^B (ext. face)	175 ^A	0.043	0.08	(0.025)

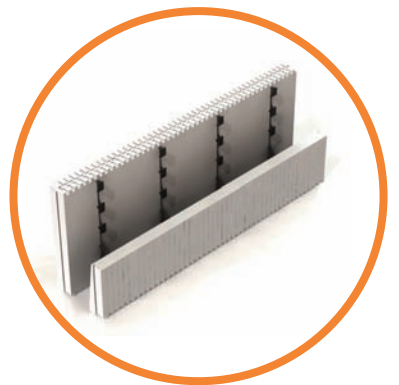
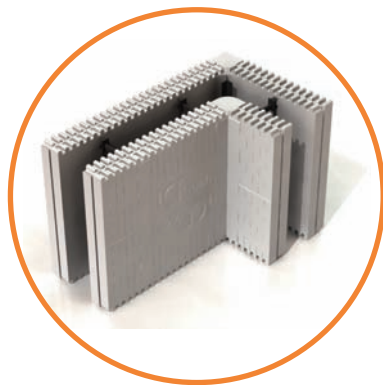
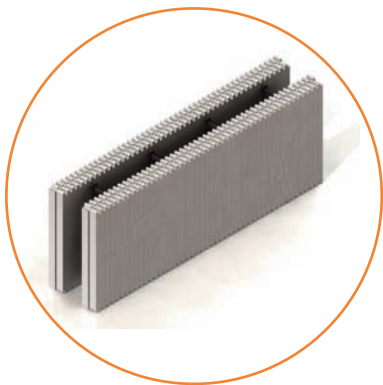


* 1 - All dimensions are in mm

2 - All Forms are 465mm high (450mm when joined together)

3 - WallForms have a 150mm concrete core and two 75mm EPS skins - 300mm overall width

4 - All FloorForms have an internal height (from base to top of corbel) of 227.5mm



10

Product codes and descriptions

10 Part codes and descriptions

CODE	DESCRIPTION
RB	REBAR CRADLE
WB	WATERBAR
FLK	FORMLOK
FL	FLOOR LEDGER SYSTEM
FC100	100mm FORMCLOSER
FC150	150mm FORMCLOSER
FCWS	FORMCLOSER WINDOW STOP
FCSP	FORMCLOSER SPACER PIECE
FCB	FORMCLOSER BRACE
SF100	HOUSEFORM STRAIGHT 100mm
ICF100	HOUSEFORM CORNER 100mm
FF100	FLOORFORM STRAIGHT 100mm
FFIC100	FLOORFORM INTERNAL CORNER 100mm
FFEC100	FLOORFORM EXTERNAL CORNER 100mm
SF150	WALLFORM STRAIGHT 150mm
ICF150	WALLFORM CORNER 150mm
FF150	FLOORFORM 150mm

Code	Description
FFIC150	FLOORFORM INTERNAL CORNER 150mm
FFEC150	FLOORFORM EXTERNAL CORNER 150mm
DIRP	DOUBLE INTERLOCK RAISING PIECE
SIRP	SINGLE INTERLOCK RAISING PIECE
DIRPIC	DOUBLE INTERLOCK RAISING PIECE INTERNAL CORNER
DIRPEC	DOUBLE INTERLOCK RAISING PIECE EXTERNAL CORNER
SIRPIC	SINGLE INTERLOCK RAISING PIECE INTERNAL CORNER
SIRPEC	SINGLE INTERLOCK RAISING PIECE EXTERNAL CORNER

Notes

think safety...

CUS/B		21	035A
UDC	JE2		

ICF Tech Ltd

ICF House,
Milborne Road,
Milton Abbas,
Blandford Forum,
Dorset DT11 0DP

T: 01258 881791

F: 01258 881770

info@ICF-tech.com

www.ICF-tech.com

ICF is a registered trademark of ICF Tech Ltd.

